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ABSTRACT

These conference proceedings report on the current trends, practices, and research in the field of educational technology. Papers and project descriptions are included on the following topics: digital portfolios; United Nations convention for children's rights; virtual communities and classrooms; study strategies; e-mail communication across the world; empowering educators with technology; electronic books; integrating technology into the curriculum; web pages and K-12 education; library media specialists in cyberspace; instructional design; Internet and intranet applications; technology planning; reengineering the education process; C++ for the Advanced Placement exam; exploring women's careers via computer dialogue; creating web page graphics; introducing teachers to the Internet; peer-to-peer relationships on the Internet; students with disabilities; laptop computer use; educational partnerships; technology as a tool for engaging learning; building network infrastructure; CD-ROM recording; leadership, change, and technology; staff development; future of technology in education; robotics; computer-based concept mapping; cooperative learning and technology; evaluating presentation packages; software code reuse; telecommunications projects; virtual practicums for preservice teachers; gender issues in educational technology; software resource management; telementoring; equal access to technology; professional development; electronic publishing; multimedia; wireless infrastructure; virtual field trips; research using the Internet; professional development; distance education; community-based planning; project-based learning; online curriculum development; computer graphics; computer programming languages; student attitudes toward online services; groupware; hypermedia; and presentation technologies. Lists are provided of local conference committee and program committee members; board of directors; society representatives; NECC conference chairs for 1996, 1997, 1998, and 1999; and descriptions of National Educational Computing Association member societies. Contains an author, affiliation, and key word index. (SWC)

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POTLATCH

@NECC97.seattle.wa.edu

National Educational Computing Conference

Conference Proceedings

Washington State
Convention & Trade Center
Seattle, Washington
June 30–July 2, 1997

Hosted By

Woodring College of Education,
Western Washington University (WWU)

Sponsored By

National Educational Computing Association (NECA)

In Cooperation With

Pacific Northwest Associates for
Computers in Education (PNACE)

Northwest Council for Computer Education (NCCE)

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NECA
NATIONAL EDUCATIONAL COMPUTING ASSOCIATION

Welcome to NECC '97

A potlatch is a ceremony commemorating an important event in the culture of Pacific Northwest Native Americans. In celebrations that often last many days, tribes serve sumptuous meals and re-enact legends about clans and ancestors using songs, dances, masks, costumes, and drums. They raise totem poles and often present gifts to all guests. Through this custom, cultural ties are renewed and strengthened.

We have selected a modified version of a potlatch as the theme for the NECC '97 conference to honor this Northwest Native American tradition.

Among technology educators, conferences are multi-faceted events marking a coming together to share information and learn. In events that often last many days, food and drink is shared, learning with technology is celebrated, the latest and greatest hardware and software are examined in relation to learning, and e-mail addresses and Web sites are exchanged. All participants contribute to a growing body of knowledge that they in turn take back with them. Through this custom, everyone leaves motivated and rejuvenated.

Western Washington University is proud to be your host in 1997 and sharing all that Seattle and the Northwest have to offer. This volume of the NECC '97 Conference *Proceedings* reports on the trends, practices, and research in the field of educational technology. It provides a snapshot of the National Educational Computing Conference and the state of technology in education at the conclusion of the 1997 school year. This report is the result of the cumulative efforts of many individuals around the world.

Tony Jongejan, NECC '97 Conference Chair
Dan Fredrickson & Chris Thorleifson, NECC '97 Conference Co-Chairs

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NECA Member Societies—1996–1997

These descriptions are provided for the professional societies/associations that belong to the National Educational Computing Association (NECA). Contact information for each society is given following the society's description.

AAHE—American Association for Higher Education

AAHE is a membership association of individuals interested in improving the effectiveness of the higher education enterprise as a whole and their own effectiveness in their particular setting. The Association's membership includes more than 8,000 administrators, faculty, and students from all sectors, as well as policy makers and leaders from foundations, business, and government.

AAHE is higher education's "citizen's organization," where individuals step beyond their special roles to address collectively the challenges higher education faces. Members share two convictions: that higher education should play a more central role in national life, and that each of our institutions can be more effective. AAHE helps members translate these convictions into action.

Through conferences, publications, and special-interest projects, members acquire both the "big picture" and the practical tools needed to increase their effectiveness in their own setting, and to improve the enterprise as a whole.

Contact: Louis Albert, AAHE, 1 Dupont Circle, Suite 360, Washington, DC 20036-1110, aahela@gwuvm.gwu.edu, http://www2.ido.gmu.edu/aahe

SIGCAS—ACM Special Interest Group on Computers and Society

SIGCAS is the Association for Computing Machinery's Special Interest Group on Computers and Society. With a membership of nearly 1,200, this professional group seeks to identify social and ethical issues raised by computer technology and to provide a forum for discussion dealing with these issues.

SIGCAS publishes a quarterly newsletter, *Computers and Society*, which is a primary source of material on this topic. As a vehicle of communication for the SIGCAS membership, it includes news, comments, and articles on any societal issues raised by computing technology. One of the few periodicals on this subject, it provides a flexible and timely forum for important, evolving topics, such as privacy, equity of access, de-skilling of the workplace, regulation of the Internet, and intellectual property rights.

SIGCAS also sponsors the Computers and Quality of Life Symposium which allows researchers and educators to come together to discuss social and ethical impact issues.

According to a recent membership survey, about 40% of SIGCAS members teach course material on computers and society. In recent years SIGCAS has organized sessions at computer conferences on new methods for teaching the ethical and social impact of computers.

Contact: C. Dianne Martin, EECS Department, George Washington University, 6th Floor, Academic Center, Washington, DC 20052, diannem@seas.gwu.edu, http://www.acm.org/sig_hp/SIGCAS.html

SIGCSE—ACM Special Interest Group on Computer Science Education

SIGCSE became a special interest group of ACM in 1970. It currently consists of over 2,000 members from the educational, industrial, and governmental communities interested in various aspects of computer science education. SIGCSE has goals of encouraging and assisting in the development of effective academic programs and courses in computer science and promoting research in computer science education.

The following are objectives of SIGCSE:

1. To provide a continuing forum for discussion of common problems among education and other computer scientists through organized meetings and symposia.
2. To publish a bulletin at least quarterly containing information aimed specifically at those interested in computer science education.
3. To work closely with the Education Board of ACM to insure implementation of effective education programs by the Association.

Contact: Harriet Taylor, Computer Science Department, Louisiana State University, Baton Rouge, LA 70803-4020, taylor@bit.csc.lsu.edu, http://www.acm.org/sigcse

SIGCUE—ACM Special Interest Group on Computer Uses in Education

SIGCUE provides a forum for the discussion of ideas, methods, and policies related to all aspects of computers in the educational process. Established in 1969 its membership (over 1,400 persons) comes from many countries and numerous, diverse institutions and businesses.

SIGCUE publishes a newsletter titled the SIGCUE *Outlook*. Recent topics have included Preservice Education in Educational Computing, International Reports on Educational Computing, and a Teacher Training Curriculum Project. SIGCUE also sponsors and organizes technical sessions at ACM annual meetings, the National Educational Computing Conference, and other national and regional meetings of interest to its members.

Among SIGCUE's goals are:

1. helping to bring the technical expertise within ACM to bear upon educational computing generally
2. cooperating with other special interest groups or educational societies to promote attention to educational computing issues
3. providing written and verbal forums for members and the educational community to exchange ideas concerning computer uses in education.

Contact: Karen Gould, Metro School District of Wayne Township, 1220 S. High School Drive, Indianapolis, IN 46241, http://www.acm.org/sig_hp/sigcue.html

SIGUCCS—ACM Special Interest Group on University and College Computing Services

SIGUCCS provides a forum for those involved in providing computing services on a college or university campus. The topics addressed by SIGUCCS include managing campus computing, computing as it relates to the overall goals of the institution, and the state-of-the-art in various types of college and university computing services, and provides opportunities to discuss and share ideas and experiences with others.

Two annual conferences are regular activities of SIGUCCS. The Computing Center Management Symposium addresses the many aspects of managing computing on campus. This includes hardware, software, planning, finances, and personnel, to name few. The User Services Conference deals more directly with the delivery of particular services to the higher education community. Tutorials on relevant issues are held at both conferences.

In other projects, SIGUCCS offers a Peer Review of the university computing function. Upon request of the computer center director, members of SIGUCCS will formally analyze and comment on different areas of the campus computing function. SIGUCCS also publishes a quarterly newsletter. We consider the newsletter our most important form of communication as it reaches all members and is subscribed to by numerous university computing centers. Conference proceedings are published either as separate documents or as part of the newsletter itself.

Contact: Chuck Chulvick, Computing & Data Services, University of Scranton, 800 Linden Street, Scranton, PA 18510, chulvickc1@lion.uofs.edu, http://www.acm.org/siguccs

AECT—The Association for Educational Communications and Technology

The Association for Educational Communications and Technology (AECT) is an international professional association dedicated to the improvement of instruction at all levels through the appropriate use of instructional technology. Founded in 1923, AECT has evolved as an organization as the technology used in education has evolved, from the early use of traditional audiovisual media to today's interactive and multimedia technology platforms. AECT members can be found at all levels of public and private education, from elementary schools to colleges and universities, as well as in the corporate and government sectors.

Organizationally, AECT has nine special interest divisions, eight chapters, 46 state affiliate organizations, and 14 national and international affiliate organizations. With over 5,000 members, AECT is the largest international association for professionals involved in the integration of instructional technology to the learning process. AECT is the United States representative to the International Council for Educational Media.

Tech Trends, in its 37th year of publication, is the Association's professional periodical. Published during the school year, *Tech Trends* features authoritative, practical articles about technology and its integration into the learning environment. *Educational Technology Research and Development*, the Association's research quarterly in its 40th year of publication, is the only refereed journal focusing entirely on research and instructional development in the rapidly changing field of educational technology.

AECT also publishes reference books on a variety of topics, including practical applications of technology, research, copyright, and standards and guidelines for the field of special interest to instructional technologists.

The AECT national convention and exposition is held each year in January or February, drawing over 12,000 participants and exhibitors. Additionally, AECT sponsors an annual professional development seminar focusing on emerging technologies and a leadership development conference for leaders within AECT and its affiliates.

Contact: Stanley Zenor, AECT, 1025 Vermont Avenue, NW, Suite 820, Washington, DC 20005, 202.347.7834, http://www.aect.org

CAUSE

CAUSE is the association for managing and using information resources in higher education, with a focus on enhancing the administration and delivery of higher education through the effective management and use of information technology.

Through its programs and services, CAUSE serves over 3,600 members on more than 1,200 college and university campuses around the world.

CAUSE member services include:

- Professional Development: through the annual conference, seminars, the CAUSE Management Institute, regional conferences, constituent groups, and recognition programs, including the CAUSE ELITE (Exemplary Leadership and Information Technology Excellence) Award, the CAUSE Award for Excellence in Campus Networking, and the Best Practices in Higher Education Information Resources award program.
- Publications: including the quarterly CAUSE/EFFECT magazine, several newsletters, the CAUSE Professional Paper Series, and other member publications.
- Information Exchange: through the Information Resources Library with more than 2,800 items, including documents contributed by member campuses, CAUSE/EFFECT articles, conference papers, and videos, and the CAUSE Institution Database (ID) Service, a

custom reporting service with data about computing environments on CAUSE member campuses.

Contact: Randy Richter, CAUSE, 4840 Pearl East Circle, Suite 302E, Boulder, CO 80301, 303.939.0314, rrichter@cause.colorado.edu, http://cause-www.colorado.edu

CCSC—Consortium for Computing in Small Colleges

CCSC is a not-for-profit organization focused on promoting effective use of computing in smaller institutions of higher education which are typically non-research in orientation. It supports activities which assist faculty in such institutions to make appropriate judgments concerning computing resources and educational applications of computer technology.

Because departments in smaller colleges and universities are usually small and not highly specialized, the Consortium encourages the sharing of expertise, effective curriculum patterns, and efficient technological applications. The Consortium is concerned with the advancement of major programs in both computer science and computer information systems, and with the use of computers in the liberal arts and sciences.

The Journal of Computing in Small Colleges is distributed to faculty in more than 400 colleges across the country. Now in its seventh volume, its five annual issues are averaging 500 pages with articles addressing the broad spectrum of curriculum and computer use in higher education.

Contact: Gail Miles, Lenoir-Rhyne College, Box 7482, Hickory, NC 28603, miles@mike.lrc.edu.

ECMI—Educational Computing in Minority Institutions

ECMI is an organization run by a steering committee representing institutions whose student body reflects a large identifiable minority population. The objectives of ECMI are:

1. Computer literacy: To create among the faculty and administrators of the minority institutions an awareness and understanding of the strengths and weaknesses, uses and issues, advantages and disadvantages, feasibility, practicability and limitations of computer applications in all aspects of society, including education.
2. Educational Computing: To narrow the gap which exists between the faculties in minority and non-minority institutions with respect to educational computing know-how and access.
3. Research Computing: To improve the computing facilities available to faculty of minority institutions for research purposes, particularly in those institutions offering graduate programs.
4. Technical assistance—consultants: To provide expert and impartial technical assistance to academic administrators of minority institutions on all phases of academic computing (Instruction and research).
5. Education programs in the computer sciences: To improve the offerings of courses and degree programs in the computer sciences at minority institutions at all levels (e.g., introductory courses, minors, 2-year degree programs, 4-year degree programs, continuing education, graduate programs).
6. Computing facilities: To improve both quality and quantity of computing facilities available in minority institutions, because experience in the non-minority institutions has shown that an adequately staffed and equipped computer center for academic computing is essential to the success of previously stated objectives.
7. Direct student assistance: To increase the availability of minority staff for the computer centers and computer science education programs of minority institutions.
8. The need for a comprehensive program: To facilitate coordination and equitable distribution of funded activities to qualified institutions, associations, etc.

Contact: Jesse Lewis, Academic Affairs, Norfolk State University, Norfolk, VA 23504, j_lewis@vger.nsu.edu.

EDUCOM

EDUCOM is a Washington DC-based nonprofit consortium of colleges, universities, and other organizations serving higher education. Founded in 1964, EDUCOM is dedicated to the transformation of higher education through the application of information technology. Through direct services and cooperative efforts, EDUCOM assists its members and provides leadership for addressing critical issues about the role of information technology in higher education.

EDUCOM's membership includes virtually every major research university in the country: 4-year private and public institutions, along with a number of 2-year colleges, overseas campuses, foundations, consortia, and research laboratories. Approximately 600 higher education institutions and 110 corporations participate in EDUCOM. Each institutional member appoints a voting representative, who serves as the link between EDUCOM and his or her institution. EDUCOM is completely self-supporting. Funds are generated from membership dues, conferences, publications, consultations, philanthropy, and collaborations.

EDUCOM is committed to the fulfillment of the potential of information technology to realize education that is active and learner centered; free from traditional constraints of time and space; lifelong and collaborative; cost- effective; responsive, dynamic, and relevant; accessible; and outcomes oriented. EDUCOM has historically supported educational networking through computer and communications technology. EDUCOM is committed to shaping the National Information Infrastructure and its uses to enable its effective use by higher education.

EDUCOM's annual conference serves as a forum for sharing concepts, developments, and ideas amongst our community. EDUCOM Review is recognized as the premier source of information on information technology policy and its impact on higher education. EDUCOM also publishes electronic newsletters for the higher education community.

Contact: Ann Messina, Membership Coordinator, EDUCOM, 1112 16th Street, NW, Suite 600, Washington, DC 20036, 202.872.4200, inquiry@educom.edu, http://www.educom.edu

IEEE—The IEEE Computer Society

The Computer Society is the world's largest association of computing professionals, with a total membership of approximately 108,000 computer scientists, computer engineers, and interested professionals. Society membership is open to IEEE members, associate members, and student members and to non-IEEE members who qualify for affiliate membership. An affiliate member is a person who has achieved status in his or her chosen field of specialization and whose interests focus in the computing field.

Every Computer Society member receives *Computer*, a peer-reviewed monthly magazine of general interest to computing professionals which also covers society news and events. Nine specialized magazines and eight transactions are also available to society members as optional subscriptions and to nonmembers, libraries, and organizations.

Magazines published by the Computer Society include *IEEE Computer Graphics and Applications, IEEE Micro, IEEE Design and Test, IEEE Software, IEEE Expert, IEEE Annals of the History of Computing, IEEE Multimedia*, and *IEEE Parallel Distributed Technology*. Research-oriented transactions include *IEEE Transactions on Computers, IEEE Transactions on Software Engineering, IEEE Transactions on Pattern Analysis and Machine Intelligence, IEEE Transactions on Knowledge and Database Engineering, IEEE Transactions on Parallel Distributed Systems, IEEE Transactions on VLSI systems*, and *IEEE Transactions of Visualization and Computer Graphics*. The Computer Society Press publishes nonperiodical literature, including tutorial texts and conference records. The society's catalog contains approximately 900 titles which are available for purchase.

The society sponsors or cosponsors more than 100 conferences and meetings ranging from workshops and symposia with a few dozen participants to major conferences with many thousands of attendees. Over 30 technical committees offer the opportunity to interact with peers in technical specialty areas, receive newsletters, and conduct conferences and tutorials.

The Computer Society has over 100 local chapters throughout the world, and an additional 100-plus student chapters which provide the opportunity to interact with local colleagues and hear experts discuss technical issues. In addition, tutorials, educational activities, accreditation of computer science and engineering academic programs, the development of standards, and an international electronic mail network all play prominent roles in the society's activities.

Contact: Mike Mulder, Center for Advanced Computing Studies, University of Southwestern Louisiana, PO Box 44330, Lafayette, LA 70504, mulder@cacs.usl.edu, http://www.computer.org/cshome.html

ISTE—International Society for Technology in Education

The International Society for Technology in Education, ISTE, is a nonprofit educational organization, with 12,000 individual members and over 60 organization and associate members.

ISTE publishes *Learning and Leading With Technology—The ISTE Journal of Educational Technology Practice and Policy* (formerly *The Computing Teacher*), *Journal of Research on Computing in Education*, *CÆLL Journal*, and books and courseware for persons interested in the instructional use of computers at the precollege level. These publications emphasize teaching about computers, teaching using computers, teacher education, and the impact of computers on curriculum.

ISTE has a substantial and growing professional outreach program. Five major components currently include:

1. Organization Affiliate Members. Members publish newsletters and/or journals, hold conferences, and directly interact with their own members.
2. Professional Staff. ISTE has a professional staff who write, edit, participate in conferences, process orders, consult by phone or mail, etc. *Learning and Leading With Technology* is put together by a full in-house production staff.
3. Ad Hoc Committees. Such a committee created the "ICCE Policy Statement on Software Copyright" and "Code of Ethical Conduct for Computer Using Teachers."
4. Special Interest Groups. ISTE has organized special interest groups for computer coordinators, teachers of educators, computer science educators, Logo-using educators, telecommunications, and hypermedia/multimedia.
5. Independent Study courses. ISTE offers seven independent study courses carrying graduate credit from the Oregon State System of Higher Education.
6. Private Sector Council. The Council represents a broad range of corporations and services in an advisory capacity to ISTE's Board of Directors.

Contact: ISTE, 1787 Agate Street, Eugene, OR 97403-1923, 541.346.4414, (fax) 541.346.5890, iste@oregon.uoregon.edu, http://www.iste.org

ISTE SIGTC—The Special Interest Group for Technology Coordinators

The Special Interest Group for Technology Coordinators (SIGTC) is a professional organization that helps technology coordinators meet the challenges of a rapidly changing field. We provide an excellent forum to identify problems and solutions, and share information on issues facing technology coordinators at the precollege level.

SIGTC publishes SIGTC Connections, a quarterly publication, through the International Society for Technology in Education (ISTE). Articles in SIGTC Connections contains helpful information and answers to questions such as:

- What are some ways technology coordinators are successfully organizing and communicating with teachers and administrators?
- What strategies are technology coordinators using to enlist the support of school boards and administrators?
- How do technology coordinators keep informed of new trends and developments in this rapidly changing field?

For general information, contact the ISTE Administrative Office: 1787 Agate Street, Eugene, OR 94703-1923, 541.346.4414, (fax) 541.346.5890, iste@oregon.uoregon.edu, http://www.iste.org

For information on ISTE's SIGTC, contact: Bonnie Marks, Alameda County Office of Education, 313 W. Winton, Hayward, CA 94544, bmarks@ctp.org, http://www.iste.org

ISTE SIGTE—The Special Interest Group for Teacher Educators

SIGTE is the ISTE Special Interest Group for Teacher Educators involved in educational technology. SIGTE provides a forum for members to share successes, raise questions, and meet the challenges of helping other professionals use technology to enhance learning and education. It publishes a quarterly journal, the *Journal of Computing in Teacher Education*, that works to provide its members with the answers to practical, leadership, research, and theoretical questions such as:

- What is happening in K–12 computer education that relates to teacher education programs?
- What funding issues are in the forefront of current preservice and inservice teaching areas
- What are the directions in teacher education as related to computer and technology education?
- How can educators become effective critics and implementers of innovations using technology?

For general information, contact the ISTE Administrative Office: 1787 Agate Street, Eugene, OR 94703-1923, 541.346.4414, (fax) 541.346.5890, iste@oregon.uoregon.edu, http://www.iste.org

For information on ISTE's SIGTE, contact: Judy Kull, University of New Hampshire, Department of Education, Morrill Hall, Durham, NH 03824.

SCS—The Society for Computer Simulation

The Society for Computer Simulation (SCS) is the only technical society devoted primarily to the advancement of simulation and allied technology. It has a worldwide membership and a network of regional councils that covers the United States, Canada, the United Kingdom, Europe, and the Pacific Rim.

Simulation is used in every scientific and technical discipline including aerospace, biomedical, business, education, engineering, and manufacturing. Areas that have been specifically recognized as important to SCS members include artificial intelligence, CAD/CAM, education, environmental issues, knowledge based systems, robotics, simulators, and standards.

The society publishes *Transactions of SCS* (an archival journal) quarterly and *SIMULATION* (a journal of applications of simulation) monthly.

Besides the flagship Summer Computer Simulation Conference, (SCSC) the society sponsors several other conferences including the SCS Western Multiconference, the SCS Eastern Multiconference, the Winter Simulation Conference, and the European Simulation Symposium.

Further information about the society can be found on its World Wide Web home page. Those without Web access may contact the society by mail, electronic mail, phone, or fax: The Society for Computer Simulation International, PO Box 17900, San Diego, CA 92177-7900, 619.277.3888, (fax) 619.277.3930, scs@sdsc.edu, http://www.scs.org

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Table of Contents

Arnie Abrams, Workshop 1
Creating Digital Portfolios

Alenka Adamic-Makuc, Traditional Poster Session 2
Kids All Over the World Used E-Mail to Implement the UN Convention for Kids Rights

Bill Adkins, Technology Implementation/Educational Reform 3
The Age of Communication: Establishing Virtual Communities

Sharon Andelora, Internet Poster Session 4
Learning Spreadsheets With Stock Quotes on Prodigy and Preparing Presentations Using the Internet

Lynne Anderson-Inman, Society Session/New Curriculum Designs/Instructional Strategies (Organized by ACM SIGCUE) 5
Study Strategies for the 21st Century

Margarita Aste, New Curriculum Designs/Instructional Strategies 6
Quipus E-Mail Spanish Projects: Defending the Ecology—Students Find Solutions

Ron Aust, New Curriculum Designs/Instructional Strategies 8
Enriching Native American Education With Culture, Community, and Technology

Ron Aust, Technology Implementation/Educational Reform 9
Empowering Educators With Technology: The Regional Technology in Education Consortia

Brenda Bagwell, Workshop 10
Electronic Books and the Mastery of Basic Skills

Greg Baker, Technology Implementation/Educational Reform 11
Just Do IT

Eileen Barnett, Technology Implementation/Educational Reform 14
Integrating Technology Into Curriculum at Small Colleges: A Faculty Development Model

Helen Barrett, New Curriculum Designs/Instructional Strategies 15
Electronic Portfolios: What's New?

Ann Barron, Paper Session 24
Web Pages and K–12 Education: Patterns of Usage

Donna Baumbach, Spotlight Session 31
The Virtual Classroom: Delivering Instruction Via the World Wide Web

Blythe Bennett, New Curriculum Designs/Instructional Strategies 33
KidsConnect: Library Media Specialists in Cyberspace

Cherie Bergeron, New Curriculum Designs/Instructional Strategies 34
Integrating Computer Literacy With K–12 Curriculum Using Instructional Design

Timothy Bess, Technology Implementation/Educational Reform 35
Transforming the Classroom With Internet Technologies

Gene Bias and Chris Carey, Spotlight Session 36
Now That You Have It, Give It Back!

Talbot Bielefeldt, Technology Implementation/Educational Reform 37
The Road Ahead: Findings and Futures

Karen Billings, Technology Implementation/Educational Reform 39
Education Technology at 'Thirty Something': Not Just Older—But Wiser!

Margaret Bingham, Technology Implementation/Educational Reform 41
Springboard to Change: A Business Approach to Technology Integration Planning

David Birchall, Paper Session 42
Maximizing the Benefits From Technology Through Re-Engineering the Education Process: An Example From Management Education

Jana Bland, Traditional Poster Session 49
Creating Replicable Technology-Based Lesson Plan

Randall Boone, Society Session/Current/Emerging Technologies (Organized by ISTE) 53
Internet Resources: Productivity Tools for the Research Community

Barbara Boucher Owens, New Curriculum Designs/Instructional Strategies 54
C++ Subset for the AP Exam: Why, What, and When

Barbara Bowen, New Organizational Structures 57
Designing District Intranets to Create the Capacity for Learning Together

Beth Boyd, Technology Implementation/Educational Reform 58
Exploring Women's Careers Via Computer Dialogue

Maureen Brown Yoder, Traditional Poster Session 59
A Beginners Guide to Creating Web Page Graphics

Sheryl Burgstahler, New Curriculum Designs/Instructional Strategies 59
Introducing Teachers to the Net: What? Where? When? How?

Sheryl Burgstahler, Paper Session 60
Peer-to-Peer Relationships on the Internet: Advancing the Academic Goals of Students With Disabilities

BEST COPY AVAILABLE

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Sally Butzin, New Curriculum Designs/Instructional Strategies 67
Tips for Successful Technology Integration: Lessons From Project CHILD

Marge Cappo, Exhibitor Presentation/Technology Implementation/Educational Reform 69
Knowledge Forum: An Application to Promote Knowledge Building in Classroom

Doris Carey, Paper Session 70
Laptop Computer Use for Communication by Students With Severe Disabilities

Jean Casey, Paper Session 78
Teacher Net: Building a New Cadre of Technology Using Teachers Online

Jeanette Cates, New Curriculum Designs/Instructional Strategies 84
Successful Partnerships: The Texas State Aquarium Computer Sea Camp 1996

Neysa Chaparro, Technology Implementation/Educational Reform 88
Technology as a Tool for Engaging Learning

Elizabeth Chaskin, New Curriculum Designs/Instructional Strategies 91
Math, Multimedia, and High Stakes Tests

Paul Christensen, Technology Implementation/Educational Reform 92
Building Network Infrastructure

Michael Clabby, New Curriculum Designs/Instructional Strategies and Workshop 94
CD-ROM Recording: It Will Work in Your Curriculum

Mary Ann Coe, Technology Implementation/Educational Reform 96
Using Technology and Systemic Thinking to Create or Enhance Learning Organizations

Kathy Coufal, Technology Implementation/Educational Reform 97
The Community Discovered: Creating a Community of Learners for Tomorrow's World

Marielizabeth Crompton, Technology Implementation/Educational Reform 99
While You Were Sleeping, Your Paradigm Shifted: Leadership, Change, and Technology; Or ... How to Change a Tire on a Moving Car While in the Fast Lane

Betty Dahl, Traditional Poster Session 100
Technology Applications on a Silver Platter

Maria Devenport, Workshop 100
Staff Development and Technology: Rethinking the Training Paradigm

Kevin Davies, Improved Productivity/Administration 102
Technological Power Tools for School Leaders

Hilarie Davis, New Organizational Structures 106
The Curriculum Commons: Teacher Collaboration for Student Learning—Millburn Township Public Schools

Jerry Dawson, Exhibitor Presentation/Current/Emerging Technologies 110
The Future of Technology in Education

Susan Dean, K-12 Computer Science 112
Using Borland's Delphi in CS 1 and 2

Janice DeCosmo, Internet Poster Session 113
Implementation of Interactive World Wide Web-Based Science Curricula

Chris Dede, Spotlight Session 114
Ten Big Questions for Educational Technology—With Some Big Answers

Chris Dede, Technology Implementation/Educational Reform 115
An Overview of the National Science Foundation's New Funding Programs

Cynthia Denton, Technology Implementation/Educational Reform 116
Using the Internet—From Learning Beginning Skills Through Integrating Quality Online Resources Into Existing Required Curriculum

Adam DiGiacomo, Exhibitor Presentation/New Curriculum Designs/Instructional Strategies 117
Developing Online Science Curriculum With PSL Excelerator and Microsoft Excel

Richard Dillon, Traditional Poster Session 118
Robotics for the Rest of Us

Leslie Ditson, Society Session/New Curriculum Designs/Instructional Strategies (Organized by ACM SIGCUE) 119
Computer-Based Concept Mapping as a Tool for Teaching and Learning

David Dockterman, Exhibitor Presentation/New Curriculum Designs/Instructional Strategies 120
Cooperative Learning and Technology

David Dockterman, Exhibitor Presentation/New Curriculum Designs/Instructional Strategies 120
Hands-On Science, High Drama, Humor

Leni Donlan and Emery (Ted) Roth II, Spotlight Session 121
Adapting for Technology: Coast to Coast

Andy Dunau, Traditional Poster Session 124
LALCNet: Los Angeles Learning Community Network

James Dunne, Technology Implementation/Educational Reform 125
TEAM: A School, University, and Community Partnership

BEST COPY AVAILABLE

J. Kit Eakle, Technology Implementation/Educational Reform 127
The Internet, The Arts, and Educational Change: The ArtsEdge Experience and What the Arts Have to Offer

Dianne Eash, New Curriculum Designs/Instructional Strategies 130
Teacher/Pathfinder: An Educational Village

Michael Eisenberg, Improved Productivity/Administration 132
AskERIC: A Model for Providing Education Information

Susan Elwood, Workshop 133
Evaluating and Exploring Presentation Packages

Kathleen Falk, Traditional Poster Session 134
Using Today's Technology to Develop Tomorrow's Skills

Ann Fleury, Paper Session 136
Code Reuse Through the Eyes of Students and Professionals

Les Foltos, Technology Implementation/Educational Reform 142
Scaling Up: Implementing Technology and Change in a Large District

Leslee Francis Pelton, New Curriculum Designs/Instructional Strategies 144
Exploring Geometry by Using VRML to Build 3-D Worlds

Jay Franco, New Curriculum Designs/Instructional Strategies 145
The School Computer Lab: A Community of Resources

Beth Fraser, Current/Emerging Technologies 148
Accessible Web Design

Betsy Frederick, Current/Emerging Technologies 151
Web Caching Server: Essential, Affordable, Powerful Tool for Networks

Betsy Frederick, New Curriculum Designs/Instructional Strategies 152
Exemplary Telecommunications Projects: Winners of the 1996 SIG/Tel Contest

Charles Friesen, Improved Productivity/Administration 152
Providing Support for Technology Coordinators (and Others) Via the Web

A. Margaret Fryatt, Current/Emerging Technologies 153
Designing Virtual Practicums for Preservice Teachers: Three Project Iterations

Lou Gershenson, Current/Emerging Technologies 160
Sony Electronics Distance Learning and WebTV

Mimi Gilman, Workshop 161
"Repurposing" Cable Resources in the Digital Classroom

Gary Gorland, New Curriculum Designs/Instructional Strategies 162
The Teen Aware Project: Using Technology to Develop Media Campaigns Promoting Teen Pregnancy Prevention

Karen Gould, Society Session/New Organizational Structures (Organized by ACM SIGCUE) 163
Systemic Thinking, Exploration, and Planning for an Educational Revolution

David Green, New Curriculum Designs/Instructional Strategies 165
The Hot Chocolate House: Engaging Students in Reading and Writing

Cathy Gunn, Paper Session 167
Teacher Change: Making Innovations Explicit

Cathy Gunn, Technology Implementation/Educational Reform 172
Change and Technological Innovations: Teacher Stories

Norton Lewis Gusky, Technology Implementation/Educational Reform 174
FoxNet: Bringing Schools and Community Together

Larry Guthrie, Paper Session 175
Integrating Technology Into Primary Grade Language Arts: Research on Apple's Early Language Connections

Deborah Gwaltney, Traditional Poster Session 181
Put Pizzazz in the Curriculum With Internet Projects

Joan Hanor, Current/Emerging Technologies 182
Gender Issues: How Women Position Themselves and are Positioned by Others in the Area of Educational Technology

Ellen Harris, Improved Productivity/Administration 184
Software Resource Management: Getting the Best for Less

Judi Harris, New Curriculum Designs/Instructional Strategies 185
Simple, But Not Easy: Practical Lessons in Telementoring

Judi Harris, Spotlight Presentation 187
Form Follows Function: Web Page Architecture for Educational Telecomputing Projects

Judi Harris, Workshop 189
Teaching Teachers to Use Telecomputing Tools

Peggy Healy Stearns, New Curriculum Designs/Instructional Strategies 190
Mapping Your Way Across the Curriculum

Michael Herbert, Traditional Poster Session 191
Educating Hospitalized and Chronically Ill Students With Virtual Reality

Belinda Hill, New Curriculum Designs/Instructional Strategies 193
The Internet, a Children's Literature Class, and Preservice Teachers

BEST COPY AVAILABLE

Cyndy Hoberman, Exhibitor Presentation/New Curriculum Designs/Instructional Strategies 196
Intellitools Language Arts: Multisensory Language Arts Software for All Students

Mary Hochsprung, New Curriculum Designs/Instructional Strategies 197
Integrating Storytelling With Technology Into the Elementary Curriculum

Elizabeth Holmes, Workshop 199
Internet K–2: Bulletin Boards for Discovery-Based Learning

Maggie Hopffgarten, Internet Poster Session 199
UtahLINK: Education's Connection to Excellence

Mark Horney, Society Session/New Curriculum Designs/Instructional Strategies (Organized by ACM SIGCUE) 201
Electronic Reading Environments for Successful Studying

Maureen Hoyler, Technology Implementation/Educational Reform 201
Real Equal Access to Technology: The Out-of-School Component

Bob Hughes, New Curriculum Designs/Instructional Strategies 203
What Can These Machines Do? A Family Literacy Project

Roy Hughes, New Curriculum Designs/Instructional Strategies 210
Eliminating the "Qualification Gap" Between Multimedia Education and Industry

Adrianne Hunt, Technology Implementation/Educational Reform 210
The Plug Project—Integrating Technology Into the Elementary Curriculum

Beverly Hunter, New Organizational Structures 211
Innovative Teachers in Remote Places: Professional Development in the Vanguard for Learning

Mary Grace Jaeger, Traditional Poster Session 212
What Are You Doing With Technology at Your School?

Elizabeth Jordan, Technology Implementation/Educational Reform 214
Power Thinking Through Science and Technology

Ian Jukes, Spotlight Speaker 215
It's Not the Internet, It's the Information: Net Savvy for the Information Highway

Ian Jukes, Workshop 221
Shifting Gears—Content to Process: The Key to 21st Century Curriculum

Vicki Kajioka, Technology Implementation/Educational Reform 222
The Electronic School

Robert Keiper, Spotlight Session 223
The Teacher as Actor: Keeping the Visuals, Vocals, and Verbals Alive in the Technological Environment

M.G. (Peggy) Kelly, Technology Implementation/Educational Reform 225
Isolation and Unique Educational Settings: North County San Diego Court Schools Link With the University

Penny Kelly, New Curriculum Designs/Instructional Strategies 226
Museum in the Classroom

Marvin Klein, New Curriculum Designs/Instructional Strategies 228
ZANY ZOO: A Collaborative Business/Education/Multimedia Development Model

Olga Klimanovich, New Curriculum Designs/Instructional Strategies 229
Belarussian-American Exchange Network: A Model

Carolyn Knox-Quinn, Society Session/New Curriculum Designs/Instructional Strategies (Organized by ACM SIGCUE) 231
Collaborative Writing Environments

Lewis Kraus, Workshop 232
How to Teach Mathematics Online With the PlaneMath Program

Paul Krocheski, Workshop 234
Lego Meets Its Mac

Mou-Liang Kung, Society Session/Current/Emerging Technologies (Organized by EMCI) 234
Electronic Publishing the Right Way

Annette Lamb, Internet Poster Session 235
Internet Tapestries: Weaving the Web Into the K–12 Curriculum

Annette Lamb, Society Session/New Curriculum Designs/Instructional Strategies (Organized by AECT) 241
Life Rafts to Submarines: New Frontiers in Teacher Education and Technology

Annette Lamb, Spotlight Session 249
Wondering, Wiggling, and Weaving: Exploring How Kids Learn With Technology

Annette Lamb, Workshop 250
Avoiding Roadkill on the Information Highway: Practical K–12 Internet Projects

Terry Lankutis, New Curriculum Designs/Instructional Strategies 255
Technology Successes and Pitfalls With Students Who Have Disabilities: Meeting the Education Technology Needs for All Abilities

Thomas Lapping, Exhibitor Presentation/Current/Emerging Technologies 258
Executive Seminar on Safe, Fast, Cost-Effective Internet Access

Bruce Larson, Traditional Poster Session 259
The Raiderlinks Project: A Laptop-Based, Interdisciplinary, High School Project

BEST COPY AVAILABLE

Tom Layton, New Curriculum Designs/Instructional Strategies 261

CyberSchool: Delivering High School Credit Classes Over the Internet

Jung Lee, K–16 Computer Science 263

Java Design Issues and Strategies for the Web's "Global Classroom"

Sandra Levin, Technology Implementation/Educational Reform 266

Educational Partnerships Open Doors

Janet Mei-Chuen Lin, Paper Session 268

The Requirements for Computer Teacher Certification in Taiwan

Mardi Loeterman, Current/Emerging Technologies 274

When Students Write With Video, Motivation and Writing Fluency Rise

Marge Lofstrom, New Curriculum Designs/Instructional Strategies 276

Wings Over Water: A Curriculum for Inquiry

Janis Lowe, Technology Implementation/Educational Reform 277

The Electronic Road Ahead: Infusing Multimedia Into the Elementary Curriculum

Chuck Lynd, Workshop 278

Dancin' With the Net: Introducing Telecommunications to the Classroom

Bryan MacDonald, Current/Emerging Technologies 279

Wireless Infrastructure in the Information Age

Susan Marino, New Curriculum Designs/Instructional Strategies 280

Collaboration Provides Mentoring, Career Exposure, and Technology Training for Girls

C. Dianne Martin, Society Session/Technology Implementation/Educational Reform (Organized by ACM SIGCAS) 281

Putting Teachers and Parents in Control: Internet Content Labeling and Blocking Technologies

LaRay Mason, New Curriculum Designs/Instructional Strategies 287

Virtual Field Trips Into Microscopic Worlds

Mary Anne Mather, Workshop 287

Teachers as Architects of Software That Really Meets Curriculum Needs

Jay Matheson, Workshop 294

Exploring the Art of Electronic Field Trips (Creating Electronically Enhanced Learning Experiences)

Kam Matray, New Curriculum Designs/Instructional Strategies 295

The Virtual Canyon Project

Mary Mauldin, Current/Emerging Technologies 299

Not Just Another URL

Patricia McClurg, New Curriculum Designs/Instructional Strategies 300

Land Use, Energy, and Human Impacts: Local Change in the Global Village

Jeanine Meyer, Internet Poster Session 301

Beowulf to King Lear: Text, Image, and Hypertext

Jeanine Meyer, Technology Implementation/Educational Reform 303

Doing Research Using the Web

Cathy Miles Grant, Technology Implementation/Educational Reform 304

Technology and Elementary Mathematics: A Lever for Change or Just Another Tool to Assimilate?

Babette Moeller, Technology Implementation/Educational Reform 305

Organizational Support and Professional Development Toward Technology Use for Inclusion

Aletia Morgan, New Organizational Structures 307

How to Manage School District Technology? The Case for a K–12 CIO

David Moursund, Spotlight Session 308

The Fifth Language: A Look Into Possible Futures of Technology in Education

Margo Nanny, New Curriculum Designs/Instructional Strategies 309

Designing Software With Thought to 21st Century Learning and Teaching Styles

Margaret Niess, New Curriculum Designs/Instructional Strategies 310

Technology: An Essential Tool in Teaching and Learning Mathematics

Margaret Niess, Paper Session 311

Integrating Computer Technology in Teaching and Learning: A Systemic Problem

Robert Nolan, Improved Productivity/Administration ... 316

Running a School Online Dramatically Improves Productivity and Administration

Todd Novakofski, New Curriculum Designs/Instructional Strategies 317

The Civil War: The Second American Revolution

Adrienne O'Neill, New Curriculum Designs/Instructional Strategies 318

Using Multiple Intelligences Theory and Brain Based Research to Design Technologically Integrated K–12 Curriculum

Adrienne O'Neill, Paper Session 319

Technology and Collegiality

Henry Olds, Jr., Spotlight Session 322

An Extended Vision of Project-Based Instruction Through Multimedia and Networking

BEST COPY AVAILABLE

Kendra Pamenter, Internet Poster 324
Community-Based Student Projects: Frank Lloyd Wright on the Web

Alex Pan, Paper Session 325
Teachers' Perceptions About Computer-Enhanced Writing: A Reality Check

Ron Pare, Technology Implementation/Educational Reform 331
Breaking Down Classroom Walls

Angie Parker, Workshop 333
The Digital Chisel Workshop

Agnes Patterson Zaorski, Traditional Poster Session 334
Public Schools Windows Online to the World Then 'N' Today: Intergenerational Living History (1900–1997) Pilot Project

Laurie Pattison-Gordon, Paper Session 335
Designing Spectacle Island: A Case Study of Multimedia and Networking in Community Action

Tim Pelton, Workshop 341
An Introduction to VRML: A Tool for Building 3-D Worlds

Jonah Peretti, Traditional Poster Session 347
Applied Sociology in Virtual Worlds

Jonah Peretti, Workshop 348
The Art and Science of Multimedia Design

Howard Perlman, Internet Poster Session 348
Water Science for Schools World Wide Web Site

Gayle Perry, Internet Poster Session 350
Distance Learning: Providing Staff Development in Context

Bill Peterson, New Curriculum Designs/Instructional Strategies 351
Intranets to Create a District Multiple Intelligence/Multimedia/Integrated Instructional Environme

Bernajean Porter, Technology Implementation/Educational Reform 353
Community-Based Planning: Leading Out Change for Technology and Learning

Jane Chu Prey, K–16 Computer Science 354
Different Approaches to CS1

Joyce Pundt, Traditional Poster Session 355
Electronic Partnerships: Bridging the School and Community

Dolores Pusins, Workshop 357
Using HyperStudio for Windows for Project-Based Learning

Dolores Pusins, Workshop 358
Using Microsoft's Internet Assistants to Author Web Pages

David Reider, Traditional Poster Session 358
Online K–12 Music Education: The Internet as a Collaborative Socializing Learning Environment

Paul Resta, Current/Emerging Technologies 360
Developing Knowledge Building Communities With Computer-Supported Collaborative Learning Environments

Paul Resta, New Curriculum Designs/Instructional Strategies 362
Developing Native American Community-Based Curriculum Resources Using VR Technologies

Virginia Resta, New Curriculum Designs/Instructional Strategies 364
Authentic Learning in Authentic Contexts: Learning Hypermedia Through Community Study

Sheila Rhodes, New Curriculum Designs/Instructional Strategies 365
Online Curriculum Development Activities

Donn Ritchie, Technology Implementation/Educational Reform 366
Adding Value to Courses With Online Support

Gay Robbins, Technology Implementation/Educational Reform 368
The Microsoft Authorized Academic Training Program

Serena Roberts, Technology Implementation/Educational Reform 371
Intranets: The World Behind the Firewall

Saul Rockman, New Curriculum Designs/Instructional Strategies 372
If Everyone Had One: The Learning With Laptops Initiative

Greg Rodrigo, K–16 Computer Science 373
Using Graphics to Get Kids Hooked on Programming

Patricia Ryaby Backer, New Curriculum Designs/Instructional Strategies 374
Using Multimedia to Expand Portfolios to Student Resumes

Mark Samis, New Curriculum Designs/Instructional Strategies 379
2025: A Virtual Fair of the Future

Faye Scannell, New Curriculum Designs/Instructional Strategies 380
Dithering Computer Art Skills Into the Curriculum

Faye Scannell, Workshop 382
Tessellation Fascination

Christine Scheer, Workshop 383
A Computer Created Hands-On Activities for Math Centers and Basic Skills

Barbara Schumacher, Traditional Poster Session 384
Treasure In, Treasure Out—Getting Wee Webbers Connected

Mike Seymour, New Curriculum Designs/Instructional Strategies 386
Heritage OnLine: Online Professional Development Courses for Teachers... Exploring the Internet for Teaching and Learning

BEST COPY AVAILABLE

Linda Sharp, Technology Implementation/Educational Reform 390
Staff Development, Making It Work: Learning Styles

Jonathan Sharpe, Traditional Poster Session 393
Project Greenskate: An Interactive Unit on Toxicology for Grades 7–12

Charles Shub, Society Session/K–16 Computer Science (Organized by SCS) 394
How to Make Your Programming Code Machine Independent

Martin Siegel, Current/Emerging Technologies 396
The Digital Learning Environment: Wisdom Tools for the Internet

Gene Silverman, Traditional Poster Session 398
Connecting Schools and the World of Work

Susan Smith, Traditional Poster Session 399
The Internet Works in Mysterious Ways

Tom Snyder, Spotlight Session 401
Technology for Teachers Who Love to Teach

Gwen Solomon, New Organizational Structures 401
The Well Connected Educator: Writing and Talking Online

Debra Sprague, New Curriculum Designs/Instructional Strategies 403
Integrating the Internet and Curriculum: A Web-Based Course for Teachers

Gary Stager, Paper Session 405
Computationally-Rich Activities for the Construction of Mathematical Knowledge—No Squares Allowed

Sunny Staron Baker, Paper Session 417
Access and Attitudes Regarding Online Services Among Socioculturally Diverse Students

Christine Steeples, Paper Session 425
Integrating Groupware Into Professional Development Programmes for Dynamic Distance Learning

Chris Stephenson, K–16 Computer Science 432
Revitalizing High School Computer Science: Finding Common Ground?

Randi Stone, Workshop 432
Joining Hands: Starting an Elementary School-Wide Keyboarding Project

Steve Storck, Technology Implementation/Educational Reform 433
Internet Education for K–12 Science Teachers

Neal Strudler, Technology Implementation/Educational Reform 435
Technology Integration in Teacher Education: A Systematic Approach

John Stryker, Workshop 436
Save the Trees With the Paperless School and Classroom: Meeting the Goals of Technology and Networks in Our School Systems With Inter-School E-Mail

John Sullins, Paper Session 437
Integration of Internet Resources Into a First-Year Researched Composition Course

Karen Swan, Paper Session 445
Hypermedia Support for Response-Based Literature Teaching and Learning

Rosemary Talab, Paper Session 454
A New Model: The Development of a "Best Practice," Outcomes-Oriented, Field-Based Graduate Classroom Technology Program

Soo Boo Tan, New Curriculum Designs/Instructional Strategies 459
The One-Computer Classroom

Bonnie Tenenbaum, Paper Session 461
A Virtual Instructional Media Center Unifying Professional Development and School Reform

Kathee Terry, Internet Poster 466
Project Athena: Earth and Space Science for K–12

LaJeane Thomas, Society Session/Technology Implementation/Educational Reform (Organized by ISTE) 467
National Educational Technology Standards (NETS) Project

Karen Thompson, Technology Implementation/Educational Reform 469
Technology Inservice: A Journey, Not a Family Vacation

Barton Thurber, Paper Session 471
The Internet and the Humanities

Bonnie Thurber, Workshop 477
Hands-On Virtual Rome! Navigating a "G" Rated Multi-User Shared Hallucination

Drew Tiene, Current/Emerging Technologies 478
Combining Distance Education and Digitized Multimedia: Some Lessons to be Learned

Neal Topp, Technology Implementation/Educational Reform 482
Evaluating a Challenge Grant: Linking Technology and the Arts With All Subject Area Learning

Louis Tornatzky, Technology Implementation/Educational Reform 483
What Helps in K–12 Technology Implementation: A Multi-State Regional Perspective

Walt Tremer, New Curriculum Designs/Instructional Strategies 485
An International Videophone Language Program

Kevin Treu, Society Session/Current/Emerging Technologies (Organized by CCSC) 487
Presentation Technologies for the Classroom

David Trowbridge, Internet Poster Session 488
Encarta Schoolhouse

David Trowbridge, Traditional Poster Session 489
The Role of the CD-ROM Encyclopedia in Student Research

Mary Ann Trower, Exhibitor Presentation/New Curriculum Designs/Instructional Strategies 489
Technology and Inclusion: A Great "Team" for Students With Special Needs

Harry Tuttle, Workshop 491
Live Cams Exhibit Student Learning

Carol Utay, New Curriculum Designs/Instructional Strategies 491
Technology Tag Team: A New Method for Training Teachers and Integrating Technology in the Curriculum

Joe Utay, New Curriculum Designs/Instructional Strategies 492
Success With Keyboarding

Janet Van Dam, Society Session/Technology Implementation/Educational Reform (Organized by ISTE's SIGTC) 494
Organizational Do's and Don'ts for Connecting to the Internet

Judy Vesel, New Curriculum Designs/Instructional Strategies 494
Classroom FeederWatch: Students and Scientists Working Together

Joseph Walters, Traditional Poster Session 495
Introducing CLEO!

Elaine Wells, New Organizational Structures 496
Leveraging Resources for Fiber Networking

Shelley Wepner, Technology Implementation/Educational Reform 498
Teaching and Learning Collaborative (TLC) in Technology

Keith Wetzel, Technology Implementation/Educational Reform 499
The Implementation of School-Based Inservice That Works

Alan Whitworth, New Curriculum Designs/Instructional Strategies 501
Moving Schooling From Knowledge Reproduction to Knowledge Building

Flint Wild, Internet Poster Session 502
To Infinity and Beyond… Exploring NASA's Electronic Resources for Educators

Art Willer, Exhibitor Presentation/New Curriculum Designs/Instructional Strategies 503
MP Express™: Multimedia Power Without the Complications or Cost

Hilda Williams, Paper Session 504
Dynamic Blueprint for Technology Integration: Evolving Structure, Construction, and Prototypes

William Winn, Internet Poster Session 511
Learning About Global Warming in a Virtual Environment

Naree Wongse-Sanit, Internet Poster Session 512
ArtsEdNet: Bringing Art Into the Classroom With the Web

Nicola Yelland, Internet Poster Sessions 513
Oz Kidz on the Net—http://www.gil.com.au/ozkidz/

Melda Yildiz, Technology Implementation/Educational Reform 515
Seeing Is Believing

Sharon Yoder, Workshop 518
Creating Synthesis Projects in ClarisWorks

Author, Affiliation, and Key Word Index 519

Workshop

Creating Digital Portfolios

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Key Words: **digital portfolios, electronic portfolios, assessment, authentic assessment, student portfolio kit, Digital Chisel**

In this workshop participants will get hands-on experience in putting together a digital portfolio to be used as an authentic assessment tool to document student progress and achievement. Portfolios are gaining popularity as an assessment alternative to report cards and transcripts. Several states now require schools to keep portfolios of their student's academic work in order to get a more detailed picture of student progress.

Portfolio development has become an important part of the school reform movement. The problem is that paper-based portfolios consume too much storage space and are not facile at exhibiting multimedia-based work samples. Digitizing the student's work makes it more accessible and easier to store, but the problem has been it has taken too much time and effort to compile the portfolio.

Certainly, portfolios are a very good way to document a student's development of creative and technical writing skills, but they can be used in so many other ways. With the multimedia capabilities of today's computers, digital portfolios can be used to showcase artwork, models, musical performances, speeches, presentations, athletic performances, community service, and even students' feelings and thoughts.

During the workshop the speaker will provide some background on what goes into a digital portfolio, why they are valuable, some of their uses and limitations, and how to create one. A comparison of several different software options for portfolio construction will be shown as well as a detailed look at the new Digital Chisel Student Portfolio Kit program that the speaker was involved in developing.

The Student Portfolio Kit, is a template application that gives students of all ages the tools necessary to build a portfolio of their work by combining sound, video, graphics, text, and animation to create a powerful multimedia representation of their efforts. It uses both templates and components from provided libraries to help students design and produce their own portfolios. It allows students to view sample portfolios to gain insight into portfolio design, while receiving prompts and instructions along the way to further facilitate the process.

One unique aspect of the program is that it is geared to have students, not teachers, create the portfolios. It includes templates for elementary, middle school, and high school students which are linked to password-secure assessment templates for use by teachers, parents, and administrators. The Digital Chisel's HTML function also gives students and schools the ability to easily display portfolios on the Internet.

Donald Graves (Portfolio Portraits) has commented that portfolios can be a used as a teaching tool:

> *"Portfolios are simply too good an idea to be limited to an evaluation instrument. Early data that show their use as a medium for instruction is more than promising.... The portfolio movement promises one of the best opportunities for students to learn how to examine their own work and participate in the entire literacy/learning process.... Our race to use portfolios with large populations runs the risk of bypassing the participation of the people most vital to its success: teachers and students."*

Traditional Poster Session

Kids All Over the World Used E-Mail to Implement the UN Convention for Kids Rights

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Key Words: **telecommunications, e-mail, kids rights, KIDLINK topic**

Several hundred children from around the world drafted The Children's Bill of Rights (CBOR) through the participation in KIDLINK KIDFORUM e-mail project. The project went on from March 1 to April 20, 1996, and involved approximately 660 participants at the age of 10–15 from 18 schools from Mexico, France, Denmark, Slovenia, Finland, Sri Lanka, and the USA. This was an excellently moderated class topic, guided by Lena Rotenberg and Lawrence de Bivort from USA. In seven weeks of e-mail correspondence children ratified The Children's Bill of Rights, which is in our opinion a very powerful document.

Specific objectives of the project for kids were to develop the awareness of a concept of a "right," and what they can do to implement their rights. They virtually enhance their verbal skills by stating Kids' Rights in simple and clear declarative sentences. They gained some understanding of a democratic process by voting on the inclusion of specific Kids' Rights in each classes' submission. Finally they approved or rejected the final product compiled from all classes' submissions.

Kids activities were as follows: to list the rights that adults and kids presently have in their countries; to propose rights that kids *should* have around the world; to decide on the inclusion of the rights proposed by the moderators, based on the U.N. Convention on the Rights of the Child in the CBOR; to conduct interviews about Kids' Rights with people in positions of power and authority, and finally to vote on the inclusion of the rights into the Final Draft of the CBOR and to post suggestions for implementation of the CBOR. All this was done through the daily interacting of the students from other schools from participating countries. We are sure that one of the most important parts of the project was that kids posted their own ideas for the implementation strategies. Thus we can say that the implementation strategies proposed by the kids had even greater power; namely they proceed from the "What can I, as an individual, do in my neighborhood?" to "What can we, all together, do in the world?" proposing rights such as the right to have home (proposed by kids without parents), the right to be respected for what they are, the right for safe and adequate schools, the right to have teachers who know their subject matter, the right to pocket money, the right to tranquillity.

The daily e-mail and Internet connection enabled kids to have fast, up to date correspondence on international level, which was due to the possibility to ask sub questions or to give explanations during the topic, irrespective of the place or time. They really worked so well together and reached consensus so often and so intelligently.

At the end of the discussion kids composed a document, called "THE CHILDREN'S BILL OF RIGHTS", starting with:

> *We, Children from seven countries and three continents, having communicated with each other over the Internet, agree that the following are natural rights of Children all over the world, and hereby ratify them, saying that they believe that a successful society invests its best resources and hopes in the success of its children. The Children's Bill of Rights includes 25 children's rights.*

But there remains the question: "How can we convince people to accept and uphold the rights contained in the Children's Bill of Rights?"

General Session: Technology Implementation/Educational Reform

The Age of Communication: Establishing Virtual Communities

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Key Words: **collaboration, videoconferencing, distance learning**

Highland Park Independent School District has an enrollment of approximately 5,600 students with four elementary schools, one intermediate/middle school, and one high school. Plans are underway to use various technologies to provide the district with resources that are needed to move into the 21st century. This session is designed to provide information about three projects that are currently underway for the year 2000 and beyond.

The first project involves improving the District wide-area network and providing bandwidth for future data, voice, and video transmissions. Key points of this part of the presentation will be the current infrastructure of the district which is utilizing an institutional loop from the local cable company running over coax. Current bandwidth is 2 MB. The District has completed its research, and is planning to implement an ATM network for the wide area network (WAN). The process used to reach this decision and the results of the research will be shared during the session.

The second project involves a project to cooperate with other districts to create a multi-district help desk (virtual help desk). There are two aspects to this support—administrative and instructional. The district, located in Dallas, Texas uses a student administrative system that is supported by a regional service center located in Houston, Texas. It also uses a financial system that is supported by a company in Denver, Colorado. In addition, there are various technology uses at the classroom level that require assistance for the classroom teacher. The size of the district dictates finding ways to use the technologies to support the use of technologies. During this session, time will be devoted to how a district can combine with other districts to create a "virtual" district to accomplish common goals in the areas of purchasing, staff development, and support.

The third project involves setting up a "virtual district" via the Internet, with a plan to expand to two-way interactive videoconferencing at the desktop. The adaptation of desktop videoconferencing to classroom settings is the unique characteristic of this project. It merges distance learning and classroom practice of small groups into a whole. No longer is a single class observing a single activity from a remote site via a large screen monitor, but several activities in the same classroom. This project involves five school districts of varying size, socio-economic, geographic, and ethnic characteristics. It involves both business and educational teamwork.

All three projects combine to illustrate how computers and telecommunications can be used to create a new way of "doing business." In each case of joint participation, there were "new frontiers" to cross. Districts had no established practice of sharing resources in this way. Highland Park ISD is using technology to "reach out" and "touch someone."

Internet Poster Session

Learning Spreadsheets With Stock Quotes on Prodigy and Preparing Presentations Using the Internet

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Key Words: **stock market, Internet, presentation, spreadsheets, Prodigy, middle school, secondary education**

Project Summary

Before the class begins work on spreadsheets, we learn a little about the stock market, the reason for stocks, and how the business and world situations affect the price of stocks. Students are given an imaginary amount of $10,000 to work with in this project. They are allowed to select three different stocks with this money. The remainder of the money is placed in a bank account. They are encouraged to discuss their selection with their parents and relatives, but the students make the final selection.

The class as a whole makes up a spreadsheet chart. As we make up this spreadsheet, we discuss the types of cells, etc. Once we make up the spreadsheet, we are ready to insert the figures.

The class is then introduced to the stock market quotes on Prodigy, an online service. The first time the students use Prodigy, they must locate and record the quote abbreviation. They find out the amount of the selling price. Using "if statements" in a spreadsheet, the students determine how many shares of each stock can be purchased with the $10,000. The rest of the amount is put into a bank account.

Each day, the students use Prodigy to find out the latest quotes of their stock and they add this information to their spreadsheet. At the end of each week, we find out which student's investment portfolio is worth the most that week. The name of the student is posted. At the end of the term, the top three students are given a certificate for their achievement in this project.

During the project, we discuss the fluctuations of the market and how world events have influenced the stock prices. After working with their investment portfolio for several weeks, students select one of their stock for an in-depth study. Using the Internet World Wide Web sites, students search their company's home page for the history of the company, company officers, the highs and lows of the stock prices, dividends, products/services of the company, and the future of the company. From this information, the students predict what the value of the stock will be in the future.

In order for the students to share this information with the rest of the class, students prepare a computer slide presentation. Using their desktop publishing skills, students import clip art from the Internet, clip art CD-ROMs, scanned images, and pictures from the digital QuickTake camera. Some advanced students will even import sound clips and QuickTime videos into the presentation. During this part of the project, students become aware of desktop publishing techniques of design, color, and placement.

At the end of the project, students present their computer slide presentation to the class. This gives the students a chance to learn how to speak in front of the class and use the computer at the same time. After each presentation, the class critiques the presentation. This allows the students to learn how to increase the effectiveness of a computer presentation for future use.

The final component to this stock market project is a field trip to the New York Stock Exchange in New York City. The students enjoy seeing the floor of the Stock Exchange in action and watching the electronic ticker tape flash the latest stock sales. During this trip, the students enjoy their lunch at McDonalds in the Wall Street area where they can view an electronic ticker tape as they eat.

Project Evaluation

The students love this project. It is an assignment in which students have to find the input, not just look at a packaged assignment. The variety of tasks they need to perform gives them an appreciation for using a spreadsheet, Dow Jones Retrieval Service on Prodigy, Internet, and a computer slide presentation. The creativity of the students' presentations is outstanding. This project does, indeed, prepare the students for the 21st century.

General Session: Society Session/New Curriculum Designs/Instructional Strategies
(Organized by ACM SIGCUE)

Study Strategies for the 21st Century

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Key Words: **electronic studying, notetaking, World Wide Web, information organization**

This presentation will provide an overview of strategies for using the computer to enhance the academic performance of secondary and post secondary students in any curriculum area. Specifically, the presenters will demonstrate four types of computer-based study strategies: (a) notetaking strategies, (b) textbook study strategies, (c) materials synthesis strategies, and (d) electronic research strategies. Using live demonstrations, the presenters will share software appropriate for implementing the computer-based study strategies and illustrate each with examples produced by students in secondary and post secondary courses. Two types of software will be shared: (a) computer-based information organizing tools such as electronic outliners and concept mapping programs and (b) electronic reference materials such as dictionaries, encyclopedias, and resources on the World Wide Web. The presenters will also provide the audience with recommendations for using computer-based study strategies to meet individual student needs. All recommendations have emerged from six years of federally funded research exploring the use of advanced technology as study tools for students in secondary and post secondary settings. Presenters will provide participants with a packet of materials designed to assist application in the classroom.

General Session: New Curriculum Designs/Instructional Strategies

Quipus E-Mail Spanish Projects: Defending the Ecology—Students Find Solutions

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Key Words: **Spanish, project, e-mail, environment, world**

Quipus is a company in Mexico that is helping schools integrate technology. We are faced with similar problems as in other parts of the world, some probably more marked because of the economic crisis which we are going through: lack of funds, teacher resistance, labs for computer classes instead of integrating technology to the curriculum, etc. The Internet provides a great way to show interesting results in a short time; e-mail especially is easy to use and can be cheap. With just one computer connected to the Internet a whole class can become involved in a project. One of the difficulties that arise is the lack of Spanish projects available. Teachers in Spanish speaking countries do not know the possibilities and are afraid to lead something new. These are some of the reasons why we started these projects. It came as a big surprise when many English speaking schools started to join in practicing Spanish, students' second language. Our e-mail projects open many interesting possibilities to both Spanish speakers and students learning this language.

Geographical Potential

Spanish is the third native language spoken by more people in the world—only Mandarin and Hindu have more native speakers. Of the total number of speakers (native and not), Spanish is fourth, after Mandarin, Hindu, and English. Spanish is the official language in most of South America, Central America, and Spain.

Native speakers have a lot more in common than just the language. When learning a language it is very interesting to learn the culture, ideas, similarities, and differences of the people that speak the language. The countries where Spanish is spoken are either neighbors or very close to the USA. There are a lot of Spanish immigrants coming to the States; Spanish words are being added to the everyday language. This makes learning the language and its people even more important.

Curriculum Potential

Learning another language is very important in the globalized world. Students are better prepared for their future activities if they can make themselves understood in more than one language. Working on our e-mail Spanish projects gives us the possibility of "talking" with native Spanish speakers. They will see and start using "live" language not just textbook words that might even be outdated. They will also learn geography, biology, history, world cultures, events, and many other subjects in accordance with the official curriculum.

Formative Potential

Students on these projects will learn that the world is a lot bigger than their country—that there are students, whose language may be different but share many similar problems. They will learn about different cultures, which will make them more tolerant of people that seem different, and which, in the long run, will make a better world with less discrimination. If they have to communicate using another language they will see it is difficult to make themselves understood, which will make them more understanding of people that make an effort speaking English.

For native Spanish speakers, it is good for them to communicate with other students in their own language. They will see the importance of their language and the wealth of their culture. They will notice that people that are trying to learn it also find it difficult, which will help them when they try and speak another language. Both will learn that the most important thing, when using a different language from their own, is to make themselves understood.

Defending the Ecology (Defendiendo la Ecologia)

In this project students try to find solutions to an ecological problem near their schools. While they do it they communicate with students in schools on other parts of the world that are also trying to find a solution to their problems. They all exchange information of the problem they have, how they are trying to solve it, and ideas to help each other and their final results.

A group of experts from the Center of Environmental Quality from the Tecnologico de Monterrey University help students, answering their questions and giving them ideas. Benefits:

- Students use Spanish.
- Students get to know people in other countries.
- Students do things to solve real world problems.
- Students get expert help.
- Students learn that working together can really make a difference.

Getting to Know the World (Conociendo el Mundo)

Once a month during the school year, schools make a one-week presentation of their country; different countries are chosen. All the participants receive the presentation on a Monday and get to ask "the experts" questions during the rest of the week. Wednesdays are used for discussing the most important problem the country faces, how other countries are affected by the same problem and ways in which it can be solved.

Some of the topics that are presented are: location, historical persons that have impressed the students the most and why, biggest problems faced, schools, where young people go to have fun, and different and interesting things in the country. Students are encouraged to add a recipe, music files, and photographs.

Benefits:

- Students use Spanish.
- Students get to know people from other countries.
- Students get to know other countries in a more personal and interesting way.
- Students get the information and their questions answered by experts.

For more information about these projects, how to join, past results, dates, etc., visit: http://www.mpsnet.com.mx/quipus

General Session: New Curriculum Designs/Instructional Strategies

Enriching Native American Education With Culture, Community, and Technology

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Key Words: **Native Americans, culture, multimedia, Internet, technology, World Wide Web**

The Four Directions project is a multi-year enrichment activity designed to empower Native American schools with technologies that serve as catalysts for curricular reform. The Internet brings to rural school and communities the opportunity to collaborate and share resources between schools and other educational institutions across the globe. Additionally, the Internet provides a mechanism for native communities to build a comprehensive collection of multimedia resources for sharing important aspects of their unique cultures and approach to learning.

Recognizing the need to make the richness of Native American cultures more accessible, Four Directions has established a distributed database for contributing, reviewing, and indexing information resources representing the individual perspective of local schools and communities (www.4Directions.org). The 4Directions Educational Resource Library accepts and categorizes curriculum materials which include student generated multimedia presentations, lesson plans, and other educational materials. The resources are accessible through multiple browsing and query functions by content, age, tribal affiliation, and other categories.

Many of the resources in the Four Directions resource library are student and teacher created multimedia presentations. Multimedia programs allow teachers and students opportunities to capture, preserve, and use many community and cultural resources in their classroom. Interactive audio and video segments function as building blocks that students use to actively explore traditional reading, writing, and arithmetic topics while expressing their native language and culture. Student and teachers use these multimedia cultural explorations to share their language and traditions both within their school and across the global Internet community.

General Session: Technology Implementation/Educational Reform

Empowering Educators With Technology: The Regional Technology in Education Consortia

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Key Words: **technology, Internet, education, teacher, planning, computers, learning**

The U.S. Department of Education's OERI office recently established six Regional Technology in Education Consortia (R*TECs) under the Title III statute known as the Technology for Education Act. The mission of the R*TECs is to assist states, local education agencies, teachers, school library and media personnel, administrators, and other education entities to successfully integrate technologies into kindergarten through 12th grade (K–12) classrooms, library media centers, and other educational settings, including adult literacy centers. The R*TECs are charged to "1) establish and conduct regional activities that address professional development, technical assistance, and information resource dissemination to promote the effective use of technology in education with special emphasis on meeting the documented needs of educators and learners in the region they serve; and 2) foster regional cooperation and resource sharing."

The R*TEC collaboratives draw on the strengths of: Regional Technology Laboratories, University Schools of Education, State Departments of Education, Local Education Agencies, and nonprofit and commercial partners in achieving their goals. Each of these partnerships offers a unique perspective for serving the needs of educators and students within their region and across the nation. Together they serve more than 15,000 Local Education Agencies and 47.5 million students.

The R*TECs are using the Internet's World Wide Web (http://RTEC.org) to extend the benefits of rapidly evolving educational technology to learners. We are leveraging this connectivity to foster progressive educational change by: increasing the awareness of parents and community leaders in the benefits of network communications and community publishing; involving educational administrators, teachers, and students in contributing ideas and resources through the Internet; and developing broadly accessible and easy-to-use systems for distributing current school reform ideas and learning technologies. Using descriptions of specific success stories from each of the regions, this presentation will provide an overview of the goals and initial activities of the R*TECs, with a specific emphasis on exemplary accomplishments that empower teachers, students, and district administrators to integrate information technologies in their schools and communities.

To learn more about the R*TEC in your region, visit the following Web sites:

South Central (KS, MO, NE, OK, & TX)—http://www.scrtec.org

North Central (ND, SD, WI, MN, IA, IL, IN, MI)—http://www.ncrel.org/ncrtec/

Pacific and South West (CA, NV, UT, AZ, NM, CO, HI)—
http://www.csulb.edu/~clmer/pswrtc/pswrtc.html

South East and Islands (AL, AK, FL, GA, KY, LA, MS, NC, Puerto Rico, SC, TN, VA, Virgin Islands, WV)—http://www.serve.org/seirtec/indes.html

North West (AK, WA, OR, ID, MT, WY)—http://www.netc.org

North East (CT, DE, DC, ME, MD, MA, NH, NJ, NY, OH, PA, RI, VT)—http://nettech.org

Workshop

Electronic Books and the Mastery of Basic Skills

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Key Words: **instructional CDs, electronic books, literature-based CDs, multimedia**

Literature-based CDs provide students with a stimulating environment of text, graphics, and sound in which to actively participate in the literary experience. In addition, they provide teachers with a means of accommodating individual differences while simultaneously focusing on meaning, interest, and enjoyment in the teaching of language arts. Elementary classroom teachers will be provided the opportunity to explore concrete methods for utilizing a wide variety of literature-based CDs to promote the mastery of basic language arts skills. Participants' explorations will include guidance in the evaluation of content and the assessment of the merits of particular titles to specific grade level objectives.

Strategies for efficient utilization of electronic books will include a comprehensive hands-on exploration of the customization features of selected titles to facilitate the introduction, extension, and building of skills of specific language arts objectives. The session will also focus on thematic and interdisciplinary teaching which will provide participants with clear direction and creative applications for the use of literature-based CDs to teach across the disciplines. The multimedia learning environment is a remarkably rich technique of instruction that enables children to formulate myriad and meaningful associations with materials they read. A variety of programs which support literacy development and allow children to learn in interactive ways will be explored.

The session is designed with the expectation that participants will glean strategies for: presenting quality children's literature via electronic books; increasing comprehension, basic skills, and enjoyment by appealing to multiple modalities of learning; promoting effective uses of good literature as an instructional tool; using literature-based CDs to teach basic skills; identifying specific literature-based CDs which support course content and specific curriculum objectives; using electronic books to assess mastery of basic skills; and promoting interdisciplinary teaching via the application of literature-based CDs.

General Session: Technology Implementation/Educational Reform

Just Do IT

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Key Words: **notebook computers, technology integration, information technology, professional development**

This session focuses on the integration of computers into the curriculum in years 7 to 12 in a large independent boys school. In particular, issues relating to:

- technology implementation
- impact on the curriculum
- research findings
- staff training, and
- future developments

will be considered. Results of research findings will be discussed, examples of students work will be shown, and plans for the future will be outlined.

Preamble

Scotch College is an independent K–12 boys school of some 1,850 students in Melbourne, Australia. Founded in 1851 it is the state's oldest school and has an outstanding academic record, a fine sporting heritage, and aims to develop to the fullest the potential of each student.

In the past five years, curriculum initiatives have been focused on educating students for *their* futures and the use of computers has become a widespread and vital part of the educational process.

Major changes are being made in this traditional and successful school which are transforming teaching and learning away from the traditional teacher center approach to one which is more centered on the student's own learning and which fosters independence, teamwork, and strategies for life long learning.

Notable Events

1992	Future and Technology Committee recognized the importance of Information Technology skills as being one of the new basics in the curriculum.
1993	Introduction of Information Technology into Year 7 integrated into the curriculum with the innovative use of a technology consultant. First use of notebook computers in classes. New Computer Centre opened encompassing design features such as a computer floor, custom designed furniture, networking, and state of the art technology. Fiber optic network backbone installed.
1994	'What every student should know'—the new basics were defined in terms of the outcomes expected from each student leaving the school Reporting system was changed to make mandatory the use of personal computers for the production of student reports.
1995	All Year 11 students (250 students) bring their own notebook computers to school New Language Centre includes a multimedia laboratory, self access areas for students and a computer floor for network access Two small teams established, each to take responsibility for the entire curriculum in two Year 7 classes. Teams were self selecting and voluntary.
1996	All Year 11 and 12 students (500 students) bring their own notebook computers to school Multimedia courses offered at Year 10 World Wide Web server connected and home page established An independent review of the use of notebook computers was carried out—results of this research will be outlined in the session.

1997	All eight Year 7 classes is being taught by small teams of teachers. One Year 8 class is taught by a small team of teachers. Webmaster takes responsibility for home page. All teachers given e-mail addresses. Selected students given e-mail addresses. Studio Arts—multimedia design and development is introduced. Independent review of Years 7 to 10 Information Technology integration will be carried out. Wireless networking with notebook computers being trialed.

Urgent Needs

The following urgent needs were identified and addressed:

- 1993 Students and parents were demanding the introduction of IT skills teaching.
- 1993 Staff training addressed through a variety of initiatives.
- 1994 Year 11 and 12 students placed great demands on our resources for the production of assessment tasks. Students began bringing their own notebook computers to school.
- 1994 Individual faculties increased demand for access to IT facilities
- 1995 Increased demand for computers for teachers addressed with a significant number of teachers given long term loans
- 1996 Decision taken to provide notebook computers for all staff over a three-year period
- 1997 Increased requests for network access led to the decision to provide network access points at all teachers' desks over a 12-month period and to provide 120 student network points during the year.

Ubiquitous Computing

The computer has been seen as an important tool in the preparation of students for life in the 21st century. Information technology skills are seen as part of the new basics and these are tightly integrated into the curriculum in Years 7 to 10.

There is a commitment to cross platform computer use and both Apple Macintosh and Windows computers are supported and used. The school has entered into a long term technology partnership with NEC Australia and is a Major Education Partner with Apple Computer Australia.

Issues for the Near Future

These issues are being considered in 1997:

- The provision of computers for all teaching staff
- Network access to all classrooms
- Notebook access to the school network
- Remote access
- The extension of the use of notebook computers to year levels other than 11 and 12
- The continued provision of appropriate and timely professional development for teachers.
- The provision of network access into the Boarding Houses
- The integration of data, voice, and video onto the one network
- The use of notebook computers in external examinations

Conclusion

Technology offers us the opportunity to transform schools such as ours and to focus on individual needs, teamwork, and independent learning. The opportunity to provide the best technology can offer to the citizens of the 21st century is an exciting one for us all.

The home page for Scotch College is: www.scotch.vic.edu.au

and this can be accessed to find more information about the school and both current and future developments.

General Session: Technology Implementation/Educational Reform

Integrating Technology Into Curriculum at Small Colleges: A Faculty Development Model

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Key Words: **professional development, funding sources**

This presentation presents a workable model for small colleges who are searching for realistic ways to integrate technology into curriculum. Ways to overcome financial obstacles and technophobic faculty will be examined.

How much progress has really been made in the integration of technology in smaller colleges where resources and technological support tends to be limited. Despite reports of advanced usage of multimedia by college and university faculty, there is little evidence to support these claims—especially in smaller schools. What are the obstacles that need to be overcome to make the necessary first steps for overcoming faculty technophobia and the lack of administrative support and resources.

This presentation will address these issues by demonstrating a successful model for integrating technology into existing courses in the area of literature and writing. The presentation will describe funding sources, strategies for pairing technological support staff with faculty members, collaborative course planning, course implementation and evaluation methods, adjustments, and future goals. There will be an honest assessment of problems that developed, the last minute glitches, and how they were dealt with. The presenter will describe how the analysis of the success and failures of these initial efforts shape future plans.

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Software

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Exotic Japan Voyager/Forest Technologies, West Dundee, IL. 800.544.3356, http://www.ForestTech.com

Grolier Electronic Encyclopedia Grolier Educational Corporation, Danbury, CT 06816. 800.243.7256

Holy Land Optical Data Corporation, Warren, NJ 07060. 800.524.2481

Inspiration Inspiration Software, Inc., Portland, OR 97225. 800.877.4292, Idearmond@inspiration.com

National Gallery of Art Voyager/Forest Technologies, West Dundee, IL 60118. 800.544.3356, http://www.ForestTech.com

Poetry in Motion Voyager/Forest Technologies, West Dundee, IL 60118. 800.544.3356, http://www.ForestTech.com

Print Shop Deluxe Brøderbund, Novato, CA. 800.521.6263, webmaster@broder.com

Survey Taker Scholastic New Media, Jefferson City, MO 65101. 800.724.4657

Theatre Game Intellimation, Santa Barbara, CA 93116. 800.346.8355, intelllfm@aol.com

Timeliner Tom Snyder Productions, Watertown, MA 02172. 800.342.0236, http://www.teachsp.com

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General Session: New Curriculum Designs/Instructional Strategies

Electronic Portfolios: What's New?

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Key Words: **electronic portfolios, alternative assessment, portfolio storage, multimedia presentations**

In the March 1994, issue of *The Computing Teacher*, I discussed the technology to support alternative assessment that was beginning to appear in the commercial marketplace as well as some practical strategies for implementation. That article began with a series of questions to keep in mind when considering the use of technology to support alternative assessment. This article expands on those questions that need to be asked (and answered) before decisions are made about a major implementation such as electronic portfolios or using technology to support observational assessment.

There are two broad categories of applications in the use of technology to support alternative assessment:

1. Programs to electronically record and store observations and/or anecdotal data about student learning, mostly by the teacher; and
2. Electronic portfolios, digitizing, and storing collections of student portfolio artifacts, using a range of technologies and multimedia elements.

This article will focus more on the second category, electronic portfolios, since there seems to be a broad interest and more variability in that implementation than in the observational assessment software, which is limited to two commercial packages (Sunburst's Learner Profile and Aurbach's Grady Profile).

This article will also use a series of questions to begin to focus the discussion of the use of electronic portfolios with the various stakeholders in the assessment process, under the assumption that developing a shared understanding within a collaborative model will lead to a more useful, productive, and successful assessment process.

Assessment systems must be judged based on the value of the information they provide for students, teachers, curriculum specialists, principals, school board members, parents, and community members. All these stakeholders make choices about students, programs, curriculum, and instruction. They must be considered within the context of intended use (Baker, 1992 in Fenton, 1996).

Before addressing these different strategies for implementing electronic portfolios, a few general questions may be appropriate to form a context from which to make decisions about assessment in general.

What is assessment and evaluation?	Assessment is the collection of relevant information which may be relied upon for making decisions. Evaluation is the application of a standard and decision-making system to assessment data to produce judgments about the amount and adequacy of the learning which has taken place. (Fenton, 1996)
What is a portfolio?	Rick Stiggins (1994) defines a portfolio as a collection of student work assembled to demonstrate student achievement or improvement. The material to be collected and the story to be told can vary greatly as a function of the assessment **context**. Vicki Spandel's definition (NWREL): A purposeful collection of students' work that illustrates efforts, progress, and achievement. Stiggins (1994) also states, "... portfolios are a means of communicating about student growth and development—not a form of assessment"(p.87).
How are portfolios usually stored (without a computer)?	Teachers and students have devised a number of strategies, from notebooks and file folders in file drawers, to pizza boxes and larger containers for more creative projects. Some teachers use photographs, audio tape, and videotape to store evidence of student work.
NOTE:	*(The information immediately below is provided by Skip Via, Fairbanks North Star Borough School District)*

What are the advantages and disadvantages of traditional "manila folder" portfolios?	Advantages: Child-centered, Minimum teacher time, Easy Storage and retrieval, "User-friendly interface" Disadvantages: Difficult to back up lack of portability, Limited shelf life
What are the advantages and disadvantages of electronic portfolios stored as "hypermedia stacks"?	Advantages: Easy to back up, Good portability, Good shelf life Disadvantages: Teacher-centered, Increased teacher time, Difficult storage and retrieval, Cross-platform incompatibility
What are the attributes of an Intranet-based system for storing electronic portfolio information?	A new model: Child-centered, minimum teacher time, easy storage & retrieval, portable, cross-platform, automatically updated, accessible user interface. New model prerequisites: Distributed storage, ubiquitous high bandwidth access, common document formats, transparent authoring tools, integrated with other applications. Web-based documents: It's here (everywhere) now, Accepted standard, Distributed storage and processing, common document standard (HTML), platform independent

What are the elements to include in any portfolio (whether traditional or electronic)?

- Learner Goals
- Guidelines for selection of materials (to keep collection from growing haphazardly)
- Work samples, chosen by both student and teacher
- Teacher feedback
- Student self-reflection
- Clear/appropriate criteria for evaluating work (rubrics based on standards)
- Standards and Exemplars—examples of good work

Why use technology to store portfolios in multimedia format?

- To make work in many media accessible, portable, examinable, widely distributable
- To make performance replayable and reviewable; it is important to see more than once
- To address ownership issues of student-created work
- To address storage issues (source: Sheingold, 1992)

Developing a Decision Matrix: Questions to Ask Before Making Decisions About Implementing Electronic Portfolios

School teachers and administrators need a decision matrix or a template that will help them decide which programs or strategies to use, based on the **Human and Financial Resources** available. I am often asked, "What is the 'best' portfolio program?" And my answer is always, "It depends!" (on the assessment context and a variety of other factors, human and technological, that exist in a classroom, school, or district). Here are a few of the questions that need to be answered before a definitive response can be made; and an important part of a collaborative decision-making process is including the major stakeholders in answering the questions that directly affect them.

Resource Questions

What is the stakeholder's prior experience in using traditional portfolio-based assessment?

1	2	3	4	5
Limited experience with storing samples of student work in file folders		Uses portfolios regularly as teacher-centered assessment tool, incorporating rubrics for evaluating student work		Prior levels plus able to manage student-centered assessment environment, including student-led conferences

What is the level of computer skills of the teachers?

1	2	3	4	5
Limited experience with desktop computer—able to use mouse, menus, run simple programs	Level 1 PLUS proficiency with a word processor, basic e-mail and Internet browsing; enter data into a pre-designed database	Level 2 PLUS able to build a simple hypertext (non-linear) document with hypertext links (using either a hypermedia program like HyperStudio, Adobe Acrobat Exchange, or an HTML WYSIWYG editor)	Level 3 PLUS able to record sounds, scan images, output computer screens to a VCR; design an original database	Level 4 PLUS multimedia programming or HTML authoring; create QuickTime movies live or from tape; program a relational database

What is the access to computers by students?

1	2	3	4	5
Students have little or no access to a computer during a typical week	Students have access to a computer for at least two hours a week. 20:1 student-computer ratio	Students have access to a computer for at least a half hour a day. 15:1 student-computer ratio	Students have access to a computer for at least one hour a day. 10:1 student-computer ratio	Students have access to a computer for at least two hours a day. 5:1 student-computer ratio

What is the level of technology competency of the student and independence in using a computer? (age-dependent)?

1	2	3	4	5
Limited experience with desktop computer—able to use mouse, menus, run simple programs	Level 1 PLUS proficiency with a word processor, basic e-mail and Internet browsing; enter data into a pre-designed database	Level 2 PLUS able to build a simple hypertext (non-linear) document with hypertext links (using either a hypermedia program like HyperStudio, Adobe Acrobat Exchange, or an HTML WYSIWYG editor)	Level 3 PLUS able to record sounds, scan images, output computer screens to a VCR; design an original database	Level 4 PLUS multimedia programming or HTML authoring; create QuickTime movies live or from tape; program a relational database

What technology is already available in the classroom?

Describe computer(s) including RAM & hard drive storage capacity—every 18 months, look for the minimum technology capability to double, and costs to decrease by half for the same power/capacity.

1	2	3	4	5
No computer	A single computer with 8 MB RAM, 80 MB HD, no AV input/output	One or two computers with 16 MB RAM, 250+ MB HD, simple AV input (like QuickCam)	Three or four computers, one of which has 32+ MB RAM, 500+ MB HD, AV input and output, scanner, VCR, video camera, high-density storage device (such as Zip drive)	Level 4 PLUS CD-Recorder, at least two computers with 48+ MB RAM Optional: video editing hardware and software

Is networking available in building or classroom or district? Is there a server?

1	2	3	4	5
No network—all stand-alone systems	Printer sharing and file sharing only via AppleTalk network	Dial-up PPP access to network through 28.8 modem	Ethernet network with 56K access to district server	Full TCP/IP (Internet access at T-1 or Ethernet speed. WWW server in building

How much budget do you have for additional hardware, software?

1	2	3	4	5
No money for additional hardware or software	$300 per classroom for additional hardware or software	$600 per classroom for additional hardware or software	$2,000 per classroom for additional hardware or software	$5,000+ per classroom for additional hardware or software

How much budget do you have for staff development (time and cost) and support?

1	2	3	4	5
No money or staff development time	After-school workshop and/or credit class on own time	Inservice days dedicated to implementation	Release time for teachers to visit other classrooms	release time plus in-class support

Portfolio Context Questions

Before building a portfolio, educators need to ask a few questions about the assessment and portfolio **context**.

Will you take a *Teacher-Centered* or *Student-Centered* approach?

Determined by who is in charge of the portfolio collection and publication

1	2	3	4	5
Teacher-Centered		**Mixed Model**		**Student Centered**
Teachers take full responsibility for all aspects of the electronic portfolio process. May have parent volunteers to assist. Little or no student self-assessment or peer/parent involvement in assessment.		Teachers share responsibility where appropriate with students. Students lead their own parent conferences. Students collect most of the artifacts, digitize some of the work. Collaboration in self-assessment is encouraged.		Students are completely in charge of their own portfolios, including digitizing work samples, storage and presentation. Students are responsible for assessing their own work, often in collaboration with peers, parents, teachers, and others.

What is the purpose of the portfolio?

The purpose of the portfolio and the varied audiences will determine much of the following context factors. These context factors relate to not only the purpose of the portfolio, but some other characteristics of the learner.

Various Assessment Purposes with my estimate of the primary audience (below are examples from a database of alternative assessment strategies published by CRESST (UCLA's National Center for Research on Evaluation, Standards, and Student Testing).

- Diagnosis of Student Learning (teachers, parents)
- Selection/Assignment to Groups (teachers)
- Grading/Course Exam (teachers)

- Proficiency Testing (teachers, administration)
- Program or Curriculum Evaluation (teachers, administrators)
- Research (administration)
- School Accountability (administration)
- School/Instructional Improvement (teachers, administration)
- Promotion/Certification (student, parent, community, i.e., college, employer)

Assumption: Different ages and audiences = different portfolios and purposes = different formats for storage and publication.

- Elementary/middle school students and their parents primarily want to see growth/progress over time. Schools often want to retain these files as part of the student's permanent record until graduation, which requires a format that is compact and transferable between schools. School districts may also wish to use student portfolios for program assessment or to document progress in students' achieving standards, which may require a format with links to a centralized student database.
- High school students often use their portfolios as exhibitions for graduation, college application, or future employment, which requires a format that is cross-platform and playable in many different contexts. Students can use their portfolios to demonstrate both academic achievement as well as personal characteristics.
- College students often use their portfolios for graduation or professional certification, and often for employment applications, which requires a format that is cross-platform and playable in many different contexts as well as demonstrating achievement of professional standards.

How will you store the portfolio?

- Computer diskette
- Paper
- Compact Disc-Recordable
- Video Tape
- High density floppy (Zip disk)
- Intranet (a network within a building or district) or password-protected server
- **How will you publish the portfolio?** (many of the same strategies shown above)
- **How will you provide for security and confidentiality of student assessment information stored in electronic form?**
- **Do you want to use technology to help collect observational assessment data?** If so, there are only two programs available commercially, Learner Profile and Grady Profile, and only Grady includes capability to store portfolio items.

Other Assessment Context Factors

- What is the *age* of student?
- What is the *time frame* to be covered in the portfolio?
- What are the *nature of the outcomes* to be assessed?
- What is the *nature and focus of evidence* being collected?
- What *multimedia formats* do you need to include to illustrate student efforts, progress, achievement?
- Do you want to correlate student performance to state or district standards; that is, document achievement of specific standards by linking them to specific evidence (artifacts, exhibitions, or performances)?

What are the multimedia elements that could be included in an electronic portfolio?

The following multimedia elements are often included in electronic portfolios. These elements are illustrated below, with comments about the type of competencies needed to collect data using the digital medium.

- **Images**—digitize graphics with a scanner or camera
  —Most people know how to use a copy machine, but may not know how to scan and display visual images on a computer. The importance of visual images is ....
- **Sound**—digitized with a microphone or camera
  —Most people know how to use a tape recorder, but may not know how to record sounds for storage and play back on a computer. The importance of sound is ....
- **Video**—digitized directly with a camera or video digitizer
  —Most people can handle the rudimentary aspects of a VCR or video camera, but may not know how to record video for storage and play back on a computer. There are also portfolio strategies for recording computer screens to video tape, especially for sharing with families. The importance of video ....
- **Text**—most often work completed by the student using a word processing program
  —Student portfolios often consist of work that is text-based.
- **Mixed media products**—students are beginning to produce multimedia projects, integrating graphics and text, and sometimes sound and video, using an authoring program, such as HyperStudio, Kid Pix, Macromedia Director, or creating WWW pages.

What are the support technologies needed to manage this digitization process?

- **Authoring Software**—a program to construct and organize portfolios or presentations
  —Most people know how to store work in paper files and folders, but do not know how to organized information electronically on a computer for easy storage and retrieval. (explained below)
- **Hardware Add-ons**—the equipment needed for each of these functions
  —Many people are learning to use desktop computers for personal and professional productivity, but may want to know which pieces of equipment could be added to a desktop computer to enable multimedia production for presentations and portfolios.
- **Platform**—The combination of operating system running on a specific computer: Multimedia can be implemented on the Macintosh OS, Windows 3.1, and Windows 95.

Comparing Multimedia Presentations and Electronic Portfolios

The difference between constructing multimedia presentations and creating electronic portfolios that contain multimedia elements lies in the assessment purpose and context. Many of the hands-on technology skills are the same.

Process for Constructing Multimedia Presentations	Process for Constructing Electronic Portfolios
• decide on goals of presentation	• decide on goals of portfolio based on learner outcome goals that should be based on national/state/local standards with associated evaluation rubrics
• describe the audience	• decide on and describe the assessment context (see above)
• decide on audience-appropriate content/sequence of presentation	• decide on and describe the audience(s) for the portfolio (student, parent, college, community?)

• decide which tools is most appropriate for the presentation context	• decide on content of portfolio items (determined by context)
• gather multimedia materials to include in presentation	• decide which software tools are most appropriate for the portfolio context
• organize in a sequence (or with hypermedia links) for the best presentation of the material	• decide which storage and presentation medium is most appropriate for the situation
• conduct presentation for audience	• gather multimedia materials to include in the portfolio which represent learner's achievement (preferably linked to standards, preferably in a relational database)
• evaluate effectiveness of presentation	• record student self-reflection on work and achievement of goals
	• record teacher feedback on student work and achievement of goals
	• organize with hypermedia links between goals, student work samples, rubrics, and assessment
	• present portfolio to appropriate audience (by student, in age-appropriate situations)
	• evaluate effectiveness of portfolio related to the purpose and assessment context

What are some multimedia tools to develop portfolios?

It is important to choose software tools that allow teachers and students to create **hypermedia links** between goals, outcomes, and the various student artifacts (products and projects) displayed in multimedia format that demonstrate their achievement. There are a number of generic types of software with examples shown of brand name products.

- Relational Databases, such as FileMaker Pro 3.0 or Oracle
- Hypermedia "card" formats, such as HyperStudio (Roger Wagner Publishing), HyperCard (Apple Computer), Digital Chisel (Pierian Springs), or SuperLink. There are commercial electronic portfolio templates available.
- Multimedia authoring software, such as Macromedia Authorware, Apple Media Tool, Macromedia Director, Oracle Media Objects
- Network-compatible hypermedia, such as HTML/WWWeb Pages, Adobe Acrobat (Portable Document Format)
- Other tool software, such as Kid Pix, integrated "works" programs, especially the "slide show" features.
- OpenDoc & CyberDog, Apple's new component software that allows links between many different types of applications within a single document.

What are some commercial Portfolio Software?

There are several commercial programs available that support electronic portfolios:

- Grady Profile (Aurbach & Associates)
- Scholastic Electronic Portfolio
- Designer Software's Electronic Portfolio Toolkit (a HyperStudio template)

- Pierian Springs' Digital Chisel with their Electronic Portfolio template
- SuperSchool Electronic Portfolio
- LearningQuest's Electronic Portfolio

Conclusions

There are many options available for implementing electronic portfolios. The best solution is dependent on an assessment of many factors that affect each of the stakeholders in the assessment process: teachers, students, parents, administrators, and the general public. Further research is being conducted to determine the best type of electronic strategy to use, based on the answers to the questions posed in this article. Preliminary results can be found on my electronic portfolio Web site which can be found at: http://transition.alaska.edu/www/portfolios.html

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Paper Session

Web Pages and K–12 Education: Patterns of Usage

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Key Words: **World Wide Web, telecommunications, elementary schools, secondary schools**

Abstract

The World Wide Web is a powerful resource for K–12 education. Never before has the educational community had such an inexpensive, easily accessible method of communicating and distributing information. Teachers and students in distant locations can exchange ideas and information, research libraries can be accessed from home computers, databases of information are available at students' fingertips, and students can interact with peers of different cultures, countries, and languages.

48

This study examined the trends in the development of the World Wide Web pages in K–12 schools. Using a random sample of school-based Web sites in the United States, the study investigated the major components that are implemented by educators and students for their schools. This study adds insight into the current status of K–12 Web sites and highlights the potential to use the Web as a communication and instructional tool.

Introduction

The World Wide Web is growing at a phenomenal rate. Since its birth in the early 1990s, the Web has become a tool for research, the dissemination of information, online exchanges, distance learning, commercial enterprise, and creativity. As with most technological innovations, the Web has caught the attention of educators, and many are exploring the use of the Web for educational purposes.

Research has demonstrated that telecommunications can enhance students' understanding and respect for cultural differences (Gersh, 1994), provide students with authentic learning experiences (U.S. Congress, 1995), increase students' inquiry and analytical skills (Honey and Henriquez, 1993), improve students' communication and processing skills, and increase the quality of student writing (Cohen and Riel, 1989; Wright, 1991). Benefits for teachers include increased collaboration and communication with their peers (Honey and Henriquez, 1993), alternative instructional strategies, and "finger tip" access to research, online experts, and an abundance of curriculum resources (Barron and Ivers, 1996).

No longer just consumers of the Web, educators are beginning to design their own school Web pages. Many educators now realize that they can use the Web to display student work, provide information about their school and programs, share resources, and seek partnerships for collaborative Web projects. With more and more schools gaining access to the Web, the use of the Web is becoming a viable tool for exchanging and displaying information among schools. This study examines trends in the K–12 presence on the Web, including Web page construction, and purpose of Web publishing.

Purpose of the Study

The objectives of this study were to investigate the issues and trends of Web pages created by K–12 schools in the United States. In particular, answers to the following questions were sought:

1. Which states are creating school-based Web pages (percentages).
2. Who is producing the Web pages—educators or students; males or females?
3. What kinds of information do schools post on their Web pages?
4. What features of HTML are included in the Web pages?
5. Which multimedia elements are being incorporated into the design of schools' Web pages?
6. What type of links are included on school Web sites?

Method and Procedure

The University of Minnesota maintains a comprehensive list of K–12 educational Web sites at http://www.coled.umn.edu. The site is known as Web66 International Web Schools Registry, in honor of the famous highway. The statistics at Web66 show that in early 1995 there were less than 200 school-based Web sites. By June of 1996, the number had risen to over 4,000 schools.

Using the Web66 site as a basis of K–12 Web pages, a random list was generated to select 5% of the schools in the United Sates for the sample population of this investigation. The resulting sample consisted of 55 elementary schools and 85 secondary schools (high schools and middle schools). The following data were collected for each school:

State
Name of school
Web address
Level (elementary vs. secondary school)
Content (school information; local information)
Graphics (image maps; photographs; backgrounds; animation)
Advanced features (forms; tables; Java; frames, flash)
Links (local; government; search engines; educational)
Media elements (audio, video)
Feedback (e-mail; counters, guestbook, update notices)
Production (student vs. educator; gender)

Findings

With the Web, anyone can become a publisher and any school can create a site that highlights student achievements and encourages global collaboration. Given the opportunity to engage in worldwide exposure, this study indicates that the initial efforts of K–12 school covers a very broad range. Some of the schools produced pages with very little merit, for themselves or for collaborative research. In contrast, several schools are unleashing a new potential never before possible at the K–12 level. This study produced the following answers:

1. Which states are creating school-based Web pages (percentages).

   The state with the highest percentage of their schools on the Web was Hawaii (14.1%), followed by Washington (7.7%), Vermont (7.4%), and Virginia (7.3%). The states with the least amount of school-based Web pages were North Dakota (0.6%) and South Dakota (0.9%).

2. Who is producing the Web pages—educators or students; males or females?

   Although it is not always clear who is the primary producer of the Web pages, there is definitely a faculty-control factor of the pages. Of the elementary schools that identified the Webmaster, 95% were produced by adults and 5% were produced by students (in conjunction with a teacher). At the secondary level, 57% were produced by adults and 43% were produced primarily by students.

   In examining the gender of the Webmaster, of those sites that identified the gender of a single person, 55% of the pages were created by males and 45% by females at the elementary level. At the secondary level, the ratio was 91% by males and 9% by females.

3. What kinds of information do schools post on their Web pages?

   As might be expected, the majority of schools (96% elementary and 100% secondary) used their Web sites to share information about their school. This information varied a great deal in quantity and quality, but it often consisted of the school's history, philosophy of education, and student population. In addition 66% (elementary) and 85% (secondary) included the school's address and/or phone number. At the elementary level, 49% of the sites posted students' work (poetry, essays, reports, HyperStudio stacks, and drawings), and 40% of the sites included classroom pages (class projects and newsletters). At the secondary level, 35% posted individual student Web pages and 67% posted information pertaining to the whole school, such as school newspapers, clubs, or athletics.

4. What features of HTML are included in the Web pages?

In the pages currently online, a wide variety exists in the implementation of advanced features. Some school sites had basic text with few, if any, features other than links and a horizontal rule line. Other sites included very advanced techniques such as Java or frames. Significant differences were noted between the features on the elementary pages and the features on the secondary pages. The middle and high schools were much more likely to include frames, tables, and forms (see Figure 1). In most cases, the forms were used for a questbook or to allow visitors to enter their names into an alumni record.

Feature	**Elementary**	**Secondary**
MailTo	82%	81%
Horizontal Rule or Line	76%	89%
Counters	35%	28%
Flash	18%	26%
Java or Javascript	5%	14%
Forms	4%	26%
Frames	0	16%
Tables	47%	62%

Figure 1

5. Which media elements are being incorporated into the design of schools' Web pages?

With regard to the media elements, there was very little variation between the school levels. The use of background colors or graphics, graphical elements, photographs, video, and audio were almost the same at both the elementary and secondary levels. Major differences were, however, noted in the use of image maps and animation techniques (see Figure 2).

Feature	**Elementary**	**Secondary**
Background color/graphic	78%	88%
Graphical element	85%	87%
Photographs	82%	75%
Image Map	2%	26%
Animation	11%	38%
Video (QuickTime)	2%	2%
Audio	4%	6%

Figure 2

6. What type of links are included on school Web sites?

Several of the school Web sites included hyperlinks to external sites. These hyperlinks were primarily to educational and local resources (see Figure 3).

External Links	**Elementary**	**Secondary**
Educational Resources	54%	65%
Local Resources	42%	69%
Government Resources	49%	14%
Search Engines	31%	44%

Figure 3

Discussion

After surveying the sites, several trends emerged:

1. The majority of schools use Web pages to publish information about their schools.
2. Emphasis, at this point, does not appear to be on instructional components or classroom publishing: less than half of the schools surveyed published students' work or classroom contributions, and only four schools were looking to engage in collaborative projects.
3. Graphics and digital photographs are the predominant media elements on school Web pages.
4. The majority of school Web sites incorporated multiple pages that were accessible from a Main Menu.
5. The most common HTML elements are "mailto" and horizontal lines.
6. Most sites are simplistic in design. Less than half of the sites surveyed included counters and few sites went beyond basic HTML components.
7. Web pages at the secondary level incorporated more advanced techniques than those at the elementary level—including more tables, frames, and forms.
8. At the elementary level, both males and females were responsible for creating the Web pages; at the secondary level, males are the predominant producers.
9. The majority of links were to local and educational resources.

Almost all of the schools used their Web presence to share the demographics and philosophy of their school. Some schools were going beyond their school information and utilizing their Web pages for instructional content, student publications, and student-centered activities.

Surprisingly, the researchers came across school sites that published students' full names, grade levels, and teachers. This is not recommended and should be avoided at all costs. Web pages should identify students' work with their first name only, or have them create a pen name to secure their identity from unwanted solicitations.

Creating and maintaining Web pages is a very time-consuming task. Several sites had problems displaying their graphics, had outdated links, or included links that resulted in error messages. At the secondary level, over 22% of the school sites contained an error message. Although some sites listed a "Webmaster," most sites were obviously the compilation of the work of a wide variety of students, teachers, and classes.

Many of the K–12 sites were very well designed, others used "bells and whistles" such as flash, Java scripts, and animation for no apparent reason. Many times, these features were more annoying and distracting than purposeful. It is hard to judge based on the information available at the sites; however, the best designed sites seemed to have a clear "leader" or "Webmaster" who, perhaps, had time to devote to the design and maintenance of the site.

In Post Hoc investigations, it was noted that an unusually high percentage (21%) of the secondary schools in the sample were private schools. Most of these private school sites were very well designed and developed. They also made use of the Web for "marketing" their school and sharing the potential of the educational environment through student newspapers and other information. In many cases, they also provided forms for interested parents and students to request more information or to apply for admission.

Conclusion

Since the summer of 1996, the number of elementary Web sites registered on the Web66 International Web Schools Registry has increased by 92%! This accelerated growth may be the result of government sponsored Net Days, educators' growing awareness of the Web, and other factors. This number still represents a small percentage of schools in the United States, but it continues to grow. One must also consider that not all school Web sites are currently registered on Web66.

With increased access to the Web, educators, and students may want to examine and redefine their use of the Web—including school Web pages. Telecommunications has tremendous potential for increasing students' communications skills, motivation toward writing, organizing and synthesizing skills, and cultural understanding. Telecommunications is often referred to as a "window" to the world; however, it appears that the majority of schools are not using the potential of their Web pages to do more than "peek through the blinds." Given that one of the strongest points of the Web is the potential for collaboration, it was disappointing to see that less than 5% of the surveyed schools used their presence on the Web to solicit or display collaborative projects with other schools.

The depth and sophistication of K–12 Web pages may increase as educators become more aware of the potential of the Web and more comfortable with the instructional applications. Similar to the introduction of computers into the classroom, when few teachers saw beyond using the computer for drill and practice, it may take some time for K–12 schools to utilize the full potential of the Web.

Sample School Sites

The majority of these sites are well designed, incorporate multiple features, and provide good models for those who anticipate designing a site for their schools.

Elementary School Sites

Arbor Heights Elementary School
(http://www.halcyon.com/arborhts/arborhts.html)

Carminati Elementary School
(http://seamonkey.ed.asu.edu/~storslee/carminati.html)

Cody Elementary School
(http://www.mil.esu3.k12.ne.us/cody/cody.html)

Columbine Elementary School
(http://www.sni.net/colelem/)

Clearview Elementary
(http://www.clearview.pinellas.k12.fl.us/)

Daniel Elementary School
(http://www.kent.wednet.edu/KSD/DE/DE_home.html)

Dodge Elementary School
(http://204.234.22.1/SDGI/Dodge.dragonWeb/main.html)

Eugene Fields Elementary School
(http://www.tulsa.k12.ok.us/~field/)

Floris Elementary School
(http://www.chaos.com/floris/)

Hillside Elementary School
(http://hillside.coled.umn.edu/)

Secondary School Sites

Cache La Poudre Jr. High
(http://alpha.psd.k12.co.us/schools/clpjh/clpjh.html)

Central Tech
(http://www.ctechok.org/)

Cincinnati Country Day School
(http://www.ccds.cincinnati.oh.us/)

Dalton School
(http://www.nltl.columbia.edu/)

Desert View High
(http://wacky.ccit.arizona.edu/~susd/dvhome.html)

Holy Cross High
(http://www.panix.com/~hchs/)

Mira Middle
(http://www.cyberg8t.com/mlms/)

Monsignor Donovan High
(http://www.mondon.pvt.k12.nj.us/)

Tower Hill
(http://www.tower-hill.pvt.k12.de.us/)

Vestavia High
(http://www.digitrends.com/vhedu/vhhs.htm)

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Spotlight Session

The Virtual Classroom: Delivering Instruction Via the World Wide Web

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Key Words: **Internet, World Wide Web, Instruction**

Instruction on the Web

One of the strengths of the World Wide Web is its multimedia delivery potential. Instructional materials can accommodate both the visual learner through text, graphics, photographs, animation, and movies, and the auditory learner through sounds, speech, and music. Instruction can take place in a directed approach through presentations, interactive tutorials, demonstrations, and simulations, or in a more discovery—learning or constructivist approach. For example, students might work in collaborative groups using subject directories and search engines to create curriculum pages with links to related resources.

Another strength of the Web for instruction is the fact that it can provide true distance learning, since the Internet is literally a world-wide network of networks. Because the majority of the delivery is not done in real-time, it can truly be a self-paced learning experience. Not only can students go through the material at their own speed, they can choose the time of day and the place in which to do so.

Designing Materials for the World Wide Web

There are a number of issues that need to be addressed in designing materials for the World Wide Web, many having to do with its inherent lack of structure. There are no built-in 3-D anchors such as chapters in books for readers of Web pages, and because most pages have external links that take readers to other documents with their own set of links, the Web is virtually unlimited in size. Users most consciously choose to access information either in sequence or in a hyper-text manner. In addition, it is generally considered uncomfortable to read long blocks of text in a scrolling screen, so readers tend to speed read articles rather than carefully reading each and every word in a long text block. All of these factors can become overwhelming and frustrating for readers, and in the case of those paying by-the-minute connection fees, cost is also an additional stress factor.

Another major factor that needs to be considered is the fact that not everyone sees a World Wide Web site the same way. There are differences among platforms, among browsers, among monitors, and among methods and speeds of access, all of which mean people will not necessarily be viewing your instructional materials in the same way you meant them to be viewed.

These issues provide us with a list of implications for Web designers:

1. All Web pages should be created with form, instructional design, and content in mind.
2. Traditional lengthy text-based information (novels, stories, and essays) should probably be downloaded and/or printed to be read.
3. Web text (for reading on-screen) should be clear, concise, and to the point.
4. Readers should be given a road map to help provide structure and feeling of control.
5. Designers should preview their created pages with a variety of browsers and equipment.

Preparing Materials for the World Wide Web

Preparing materials for the Web can take many forms, from merely placing existing files on a server to creating totally new forms of instruction specifically for use on the Internet. Each has its strengths and weaknesses, problems and rewards:

1. Place existing files on a server for downloading.
2. Convert existing files to HTML.
3. Convert existing files to a common document format, such as Adobe Acrobat PDF.
4. Create materials specifically for the Web using HTML editors, presentation, authoring, graphics, animation, and sound tools.

Generating Interaction When Using the Web for Instruction

One of the biggest drawbacks to any distance learning model is the potential loss of interaction found in a traditional classroom; student to student, student to teacher, and teacher to student. Web pages and other Internet resources can provide a number of ways to encourage different levels of this communication and interaction. For one-way communication to instructors, forms can be created on Web pages to gather information from students. For more interactive communication, e-mail links on Web pages; in addition to e-mail, listservs can provide a very useful conduit for interaction within the class. For even more interactivity, real-time meetings or chats can be held amongst any or all class members.

Creating and Delivering Instruction on the World Wide Web

No matter the level of the student or the content of the lesson, a few guidelines for using the Web to deliver instruction may make life easier for both the instructor and the students:

1. Plan for contingencies (server down, lines congested, etc.)
2. Pilot the mechanics and pay attention to the small stuff
3. Create and use templates
4. Remember learning and communication principles still apply
5. Use the medium to update, streamline, and revise the instruction
6. Keep it simple
7. Address multiple learning styles whenever possible
8. Budget additional time for all phases
9. Ensure access
10. Adopt standards and stick with them for awhile.

This session provides a look at a wide variety of ways to use the World Wide Web for delivering a wide variety of instructional content and methods to a wide variety of learners. The endless combinations of these variables provide much potential for teaching, for learning, and for research.

General Session: New Curriculum Designs/Instructional Strategies

KidsConnect: Library Media Specialists in Cyberspace

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Key Words: **cybrarian, K-12 education, library media specialist, Internet, curriculum, question and answer service**

Behind the Scenes at KidsConnect

KidsConnect is a question-answering, help, and referral service for K-12 students on the Internet. The goal of KidsConnect is to help students access and use the information available on the Internet effectively and efficiently. KidsConnect is a component of ICONnect, a technology initiative of AASL (American Association of School Librarians, a division of the American Library Association). ICONnect is designed to offer school library media specialists, teachers, and students the opportunity to learn the skills necessary to navigate on the Information Highway. Library media specialists from around the world are collaborating on KidsConnect to provide direct assistance to students looking for resources for school or personal interests. Students use e-mail to contact KidsConnect and receive a response from a volunteer library media specialist in two school days. KidsConnect volunteers point students in the direction of resources to try, both electronic and print. KidsConnect volunteers refer all students to their own library media specialists for further assistance. KidsConnect is hosted by AskERIC and the ERIC/IT Clearinghouse and is underwritten by Microsoft. This presentation will give a behind the scenes look at KidsConnect and discuss the plan and the reality of the project, the operation of the service, the nature of the questions and responses, the key skills needed by participants, the training of volunteers, implications for today's library media programs, and future concerns.

KidsConnect Networker

KidsConnect is a question-answering, help, and referral service for K-12 students on the Internet. The goal of KidsConnect is to help students access and use the information available on the Internet effectively and efficiently. KidsConnect is a component of ICONnect, a technology initiative of AASL (American Association of School Librarians, a division of the American Library Association). ICONnect is designed to offer school library media specialists, teachers, and students the opportunity to learn the skills necessary to navigate on the Information Highway.

Library media specialists from throughout the world are collaborating on KidsConnect to provide direct assistance to any student who is looking for resources for school or personal interest. Students use e-mail to contact KidsConnect and receive a response from a volunteer library media specialist within two school days. KidsConnect volunteers point students in the direction of sources to try. They do not usually give direct answers to questions. KidsConnect volunteers refer all students to their own school library media specialists for further assistance. If your students would like to send a question to KidsConnect, the e-mail address is: AskKC@iconnect.syr.edu

If you would like to know more about KidsConnect, the URL is: http://www.ala.org/ICONN/kidsconn.html

If you would like to learn more about participating as a volunteer and taking the online training sessions, please contact the KidsConnect Coordinator, Blythe Bennett at: blythe@ericir.syr.edu

ICONnects components are: Curriculum Connections, Mini-Grants, Online Courses, and KidsConnect. For more information about ICONnect, the URL is: http://www.ala.org/ICONN/index.html

KidsConnect is hosted by the ERIC Clearinghouse on Information & Technology, sponsored by the American Association of School Librarians and underwritten by the Microsoft Corporation.

General Session: New Curriculum Designs/Instructional Strategies

Integrating Computer Literacy With K–12 Curriculum Using Instructional Design

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Key Words: **instructional design, curriculum integration, K–12, computer literacy, teacher education, application software, Internet**

Presenters will share three instructional modules based on sound instructional design principles and using computer applications (Netscape, Eudora, Microsoft Excel, Microsoft PowerPoint) to meet specific curricular goals. Each module includes instructional goals, behaviors/characteristics of target population, performance objectives, teaching strategies and materials (including use of computer capabilities), and evaluation of student performance. Presenters will share formative evaluations of each module completed through field testing. The focus of each instructional design is described briefly below. Taken together, all three modules emphasize the integration of computer literacy skills with "regular" classroom curricula, supporting discipline-related goals rather than treating computer literacy as an "add-on" or extra class.

(1) **Participating in project based activities dealing with real world applications.** The goal of this instructional design is for students to access the Internet to participate in project-based activities with real-world applications using Netscape and Eudora. Two such projects are "Geogame" and "Live From Mars." In "Geogame" students must use clues provided through e-mail to locate the city of another school participating in this activity. This project requires students to use map skills learned in Social Studies and reference skills taught in Reading. "Live from Mars," an interactive project sponsored by NASA in conjunction with current Mars missions, is a year-long project incorporating skills learned in Math (geometry, computation, and logical reasoning), Science (Earth and planetary geology, data collection, and data interpretation), Social Studies (map reading), Language (written expression and debate), and Reading (summarizing, outlining, categorizing, vocabulary development, and comprehension). Internet skills learned include selecting appropriate material from an Internet search, creating and organizing bookmarks, downloading, saving, or printing information, and corresponding

with others through e-mail. Instructional strategies include student guides (simple flow chart and manual), student-teacher interaction, and cooperative Internet projects.

(2) **Combining science and technology with spreadsheets.** To combine Science and Technology, a unit was devised that allowed students to collect and chart data and interpret their results. The goal of this four week unit is to allow fifth-grade students to grow pinto bean plants in order to determine the effects of vitamins B, C, E, multi-vitamin, Miracle Grow, and water (control) on the growth of pinto bean plants. Students will use a centimeter ruler to measure the height of the plants, record their observations on a chart, and graphically display their results using Microsoft Excel. Skills include understanding measurement using the metric system, recording observations, creating a spreadsheet, designing a data table, and developing a data chart using Microsoft Excel's Chart Wizard. Instructional strategies include student help manual, student-teacher interaction, and student-produced charts.

(3) **Combining reading and technology with presentation software.** In order to combine Reading and Technological objectives, a unit was developed to combine the two curricula in the regular classroom. At the end of a nine-week period, fourth-grade students will develop a biographical book report slide show using Microsoft PowerPoint, a presentation program, installed on the classroom computer. Skills include identifying facts and supporting details, and determining the essential qualities that made that person unique. The slide show will represent a summary of the biography and will highlight the spirit and image of that person. Instructional strategies include student help manual, flow-chart, student-teacher interaction, and student produced slide show book reports.

General Session: Technology Implementation/Educational Reform

Transforming the Classroom With Internet Technologies

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Key Words: **Internet, planning, staff development**

Over two decades ago, the computer became the new tool for schools. Schools are changing the way they use computers. Computers have become a powerful tool for both the educator and the learner. Schools who use technology effectively as a tool are creating a new era and changing the way we look at learning.

As schools are coming of age in their use of technology, they must make decisions about what types of hardware and software to purchase. Using the case studies of Hillside Elementary and a Hawaiian school, this session will cover how a school can proceed in making important technology purchases. One of the biggest obstacles when making technology purchases is addressing training and access issues. Learn how Hillside and Hawaii have created an effective network of teachers and students working together to make the most of their technology.

Spotlight Session

Now That You Have It, Give It Back!

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Key Words: **community, collaboration, resources, student projects, teamwork, responsibility**

For schools to approach community organizations and offer to do something for them, as opposed to asking for something, seems to be a novel idea. But this is exactly what Orange County is trying to do. Because of this, community organizations are responding by working more closely with schools and students directly.

Orange County Public Schools district personnel and students are collaborating with the Orlando Museum of Art to design and produce an interactive CD which features the museum's permanent collection of pre-Columbian art. The CD will use Apple Computer, Inc.'s latest technology, and QuickTime Virtual Reality, to highlight each object and to give the user the ability to manipulate and move the object on the computer screen. This allows the viewer to see the art as never before, since the object can be rotated 360°. Additionally, written information will be accompanied by narration in English, Spanish, and Haitian-Creole. Plans also are for future editions of the CD to include American Sign Language, Vietnamese, and Portuguese. Orlando, and Central Florida in general, is a community of diversity. There are large populations of African-American, Hispanic, Haitian-Creole, Asian, and Portuguese people. This project is designed to give all visitors to the museum, and students, more access to information by providing it in a variety of formats and languages.

Enough CDs were produced so each school in the seven county area served by the museum received a CD for permanent use in their school. Since most schools have classes visit the museum during the school year, the CD can become a resource students and teachers can use both prior to their visit and as follow up after the visit. Students will be able to use the photographs, text, and sounds in constructing individual reports about their experiences at the museum.

This is just one of our projects involving students working with various community non-profit organizations to provide services which were not normally available to them except by professional organizations.

Students working on these projects are learning skills which will make them more employable in today's technology-rich environment. By working directly with community agencies, they learn the necessity of teamwork, collaboration, personal responsibility, and time management; skills which they often have difficulty realizing the importance of in a traditional classroom setting. Teachers are facilitators in this project. Students learn to find and use resources whereever they exist. Teachers soon realize their role is less directive, but essentially more important, than it is in a traditional classroom.

With the advent of newer technologies, we have discovered over the past few years that students have the capability to perform to the highest expectations and quality control if given the opportunity and support necessary by their teachers. By giving students the responsibilities and expectations for superior work, they respond by taking ownership of these projects and producing results which meet those expectations. Because of this method of teaching and learning, students realize that they can, and do, provide a valuable service to the community, and, as a result, take greater pride in performing their work.

All communities have needs which can be met by involving schools as partners in developing products useful both to the community and the schools. If teachers and students are invited to participate in these activities, the learning experience becomes one in which the student sees that what he or she does has relevance to the community. If schools are interested in becoming involved in these types of projects, the only thing they need to do is identify possible collaborators and approach them with the question "What can we do for you?" Since the community has for so long been used to education asking them for help, it comes as a surprise to be offered help by the schools. Thus both the community and school benefits from this relationship.

This concept has worked so well with our students and teachers that for the past two summers we have offered district-wide workshops to all 13 high schools and 23 middle schools. We have invited them to send a team of a teacher and two students chosen by the teacher to attend a two-week workshop where each team is given a PowerMac computer and four pieces of multimedia software. The teams are taught how to use the software, plan a multimedia project, and actually research and construct a mini-project while in the workshop.

Teachers participating in the workshop receive a daily stipend of $50 plus 60 inservice points toward recertification. Students receive a semester's elective credit. But more enticing, the team gets to keep the computer and software for their classroom.

We ask the teams to use their new technology expertise in their content areas throughout the year and to teach other students and teachers how to use and incorporate multimedia into their classes.

The funding for these workshops has come from district technology incentive funds. The per-team cost is approximately $3,000. The response by participating teams has been extremely positive with many schools calling to find out how they can get into the next workshop.

The bottom line is this: Once you have the equipment and expertise to create student projects within your classroom, get the students involved with the community by creating something the community can use... then share that knowledge with other teachers and students so they can do the same thing in their classrooms and community. This way, everyone benefits... the students, because they are giving something back to their community... the teachers, because their students take more responsibility for their learning... and the community, because it sees real results of students taking responsibility for their learning.

General Session: Technology Implementation/Educational Reform

The Road Ahead: Findings and Futures

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Key Words: **partnerships, school-community, professional development, NFIE, ISTE, Microsoft**

Twenty-two school/community partnerships in 15 states participated in The Road Ahead, a program administered by the National Foundation for the Improvement of Education (NFIE), funded with proceeds from the book *The Road Ahead* by Microsoft co-founder and CEO Bill Gates. This two-year program (September 1995–August 1997) emphasized:

- Partnerships of schools, after-school programs, and community-based organizations to "design and implement collaborative, student-centered activities that demonstrate how teaching and learning are facilitated by multimedia and telecommunications technologies."
- Ongoing support consisting of conferences, online networks, and teacher mentors throughout the development and implementation of the teams' programs.

Sites in The Road Ahead each received $30,000 grants, spread over the two years of the program. The schools included elementary, middle, and high schools in partnerships with businesses, libraries, museums, Senior centers, recreation departments, and colleges and universities. Technologically, sites span the range from state-of-the-art digital imaging to one-computer classrooms.

Program evaluators from the International Society for Technology in Education (ISTE), along with NFIE staff, drew on surveys, interviews, online transcripts, and site visits to examine four areas of inquiry—student learning, professional development, technology use, and systemic change.

Findings

Investigations will continue into the first months of the 1997–98 school year following the end of the program. However, preliminary findings from the program include:

- Increased learner engagement, including such observations as typically absent students showing up for computer-related activities and field trips, passive or reluctant learners taking on independent assignments, and students giving up recess or lunch periods to work with technology.
- Students at all sites showed improvement in technology skills. Each site had different activities. The range of student technology use included hypermedia and multimedia reports, digital graphics, Web pages, CD-ROM databases, videoconferencing, science probes, and productivity tools such as word processors and spreadsheets.
- Teachers teaching teachers was the dominant model of professional development. Staff training took place in the form of staff-run inservices, workshops, or informal help sessions.
- Teachers learning and integrating technology. Again each of the 22 sites had its own focus, but new teacher activities included word processing, computer graphics, telecommunications, and hypermedia authoring. Integration activities included helping students develop hypermedia stacks, organizing keypal projects, and assigning research using electronic source materials.

- Ongoing need for technology access and technical support. Problems included not enough workstations, incomplete local area networks, lack of phone lines and online accounts, and lack of technical support.
- Partnering required new learning. Prior experience working together projects was important to team successes. Difficulties included coordinating daily schedules of organizations, and learning to negotiate with outside agencies or with different levels within a school district.
- Roles of teachers and students changed as students assumed roles as teachers, and teachers assumed responsibility for teaching one another. Many reported moving to less didactic "guide-on-the-side" instruction.
- The technology activities provided by the grant turned some nonacademic after-school periods into active learning time. When the after-school activities were aligned with the classroom work, students applied their skills during regular school hours.
- Technology assumed a higher budget profile. Sites specifically mentioned the importance of having school and/or district administration support for the program, enabling critical decisions such as reallocating funds and granting release time for staff development.
- Many sites listed lack of time as an impediment to carrying out the program. Program activities competed with other teaching duties; the attention attracted by the grant brought new and unforeseen assignments; or technology skills and access were not evenly distributed, resulting in one or two members of a team having a disproportionate responsibilities. Solutions included creative use of periods during the school day, restructuring the school day into longer periods, additional partnerships with parents or businesses, and district or building arrangements for release time.
- A small but dedicated team of educators, backed by the resources and prestige of a modest grant, can make a significant difference in a school. The increased attention and resources to direct participants provided example and encouragement for further growth. Some teams actively "spread the wealth" through sharing of equipment and training.

Additional information on the findings and recommendations arising from The Road Ahead will be made available through the Special Projects area of the ISTE Web site at http://www.iste.org/ and The Road Ahead area of the NFIE Web site at http://www.nfie.org/.

General Session: Technology Implementation/Educational Reform

Education Technology at 'Thirty Something': Not Just Older—But Wiser!

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Key Words: **education technology, historical perspective, curriculum integration**

Abstract

Turn the pages of our 30-year history and see how the key people, places, and projects have contributed to a more effective use of technology in schools.

A Tour Through Our Historical Scrapbook

We all share a rich and important history in the field called technology in education, whether our first computer language was BASIC, Logo, HyperCard, or Java; our first computer was a mainframe, desktop, or laptop; our first software package was Lemonade Stand, AppleWorks, or America Online, or whether we believe computers should be used with students as tutors or tools.

For the past 30 years, key events, people, places, and projects have not only supported a steady, strong growth of technology in schools, but have also created some very effective uses. We need to acknowledge the people who have influenced the direction of technology use, to recognize the work that remains important through the years, and highlight the key ideas that have contributed to effective uses of technology.

Changes Over Time

Using prior NECC conference programs, we see how the technology and its uses have evolved in schools in our recent past. Over five-year periods, we find that the program topics shift in the following ways:

- 1980: BASIC programming, CAI, computing competencies for teachers
- 1985: Logo, computer literacy, ethics/software copyright, computer science AP courses
- 1990: HyperCard, desktop publishing, computers in curriculum areas, telecommunications
- 1995: curriculum integration, multimedia, networks and the Internet, distance learning.

If there had been an NECC conference in 1970 and 1975, what key topics and issues would have appeared on the program? If we could plan the NECC programs for the years 2000 and 2005, where would our emphasis lie?

The Key Contributions

It's important to note the role and contributions of key elements that helped create this field called education technology. How did some of the states, NSF projects, federal government agencies, colleges of education and computer science, conferences and trade shows, hardware and software companies, basal and supplemental publishers, professional organizations, technology magazines, and journals support this field? Most important, we want to understand how all of these contributors and events CONNECTED at various times to build a community with purpose and to produce results we are now proud of.

We will acknowledge people from the developers of programming languages to the publishers of educational software and from our strongest evangelists to our harshest critics. We'll look at NSF projects that became successful products, which in turn spawned education software companies. We'll highlight key organizations, educational technology programs, and model technology sites that contributed over the years. Most importantly, we will acknowledge the thousands of educators who made things happen in their schools with their passion and hard work.

Summary

By turning the pages of our 30-year-old education technology scrapbook, we can see not only the changes that occurred, but discover the guiding principles and ideas that have remained the same. Finally, we'll create some new pages in the scrapbook and predict the forces that will continue to shape technology use in education.

General Session: Technology Implementation/Educational Reform

Springboard to Change: A Business Approach to Technology Integration Planning

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Key Words: **technology planning, technology integration, student achievement, teacher productivity, cost effectiveness, technology reform, business plan**

Abstract

As a result of the North Carolina Instructional Technology Planning Initiative, by May 1996, all 118 North Carolina school districts had a state approved instructional technology plan aimed at improving and enhancing classroom instruction. The goal was to improve student performance and address the following needs: mission and vision, instructional technology initiative, technical infrastructure, personnel, staff development and training, procurement, financial analysis, monitoring/evaluation, and local school district technology planning processes.

This well-constructed, dynamic planning process, and the continued emphasis on evaluation of impact have positioned North Carolina school districts to better meet the state's goal of preparing students for the 21st century. It is hoped that students will be enabled by technology to solve problems, improve their productivity, and gain the skills necessary to become contributing members of their community and life-long learners.

Planning

The formalization of the planning process encouraged each school district to view itself as a local business enterprise providing education to students and, as such, to define its technology goals with industry standard terms and solutions. Thus, local school district plans can be incorporated into the statewide comprehensive LAN Management Program. Schools will be able to function as full business partners in the North Carolina Integrated Information Network which includes the North Carolina Information Highway. School technology initiatives have been pursued in collaboration with community colleges, local governments, and state agencies. Their plans have articulated sound business cases for funding requests, for staff development, and for improving technology competencies.

Impact

By establishing expected results and achieving consensus during the plan development stage, the school systems have discovered that employing evaluation strategies gives them energy for implementation amidst challenges and for establishing business collaboration.

The ongoing impact of the technology initiative is being measured by marking the effect in four areas:

- student achievement
- student workforce readiness
- teacher productivity
- cost-effectiveness

Presentation

This presentation will discuss the components of the planning process, technical standards, technical infrastructure, focus of business strategies, documented outcomes, funding, evaluation, impact on teachers and staff, and cost effectiveness. Materials to be distributed include plan checklists, sample spreadsheets, evaluation forms, equipment inventory, survey, listing of Web sites, and reference schools.

References:

See Web site: http://www.dpi.state.nc.us (under Resources) for:

1. North Carolina Instructional Technology Plan
2. North Carolina Technological Recommendations and Standards
3. Reference Schools and School Systems
4. Technology Competencies for Educators
5. Computer Skills Curriculum for Students
6. Wide Range of Technology Support Documents and Resources

Paper Session

Maximizing the Benefits From Technology Through Re-Engineering the Education Process: An Example From Management Education

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Key Words: **technology, learning, groupware, re-engineering**

Abstract:

The convergence of information and communications technology is having a major impact, not only in the world of work but also on leisure and education. Educational institutions are coming under increasing pressure to increase the quantity of provision and at the same time increase the quality of output. Technology is seen by many policy makers as a way forward.

However, much of the development work in applying technology has focused on a particular medium or method, but could a much more radical approach result in a more integrated application of technology throughout the learning process and the realization of significant benefits?

In this paper the authors draw on their experiences of developing a technology strategy for a UK Business School to support not only its 6,000 distance learning MBA students but also the 1,000 participants each year joining residential and other real-time programs. In examining the role of technology in education, they build on lessons learnt from attempts in both industry and public institutions to re-engineer processes and identify issues facing educational institutions that they feel are in need of urgent attention.

Moving From Automation to Transformation

Earlier applications of information technology within organizations focused on mechanization and then automation of organizational processes. Computers were seen as ideal for routine tasks in areas such as order processing, billing, record keeping. As a further example, within education, computer based training was used in an attempt to mechanize the delivery of teaching.

However, with advances in computing and the convergence of information and communications technologies, there is a widespread recognition that a focus on automating existing processes fails to achieve the potential possible which could result from more radical questioning of processes and procedures.

The term 're-engineering' was first introduced into common business usage by Michael Hammer in 1990 and defined with his co-author in 1993 (Hammer and Champ) as:

> *'Re-engineering is a fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed.'*

Whilst re-engineering has been criticized for being too limited in scope (McHugh et al. 1995, Gouillart and Kelly, 1995, Hamel and Prahalad, 1994), and for failing to take into consideration the human dimension (Mumford, 1996), the concept has nevertheless had appeal with CEOs. Many organizations have claimed radical improvement by re-engineering processes resulting in the speeding up of work processes, improving cycle times, and the achievement of more with less resource. Such improvements have not been the result of automating existing processes but rather from recognizing and breaking away from outdated rules and fundamental assumptions that underlie the design of organizations (Peppard, 1995). Nor have the results been achieved without 'pain.' Fundamental questioning of the 'why,' 'what,' 'how,' 'when,' and 'where' is bound to lead to disruption of comfort zones within organizations.

Technology in Education

Weaknesses in the educational system are being exposed in many countries as their economies move to knowledge-based activities and skills shortages hinder development. The problems have been exacerbated by the inadequacy of employer training over a long period, the lack of opportunities offered for those working within small to medium enterprise, and the absence of support for the unemployed. Given that in many countries the scale of the need, the budgetary constraints, and the shortage of qualified educators severely limit the opportunities for traditional approaches to meet these demands, policy makers, as well as practitioners, are increasingly turning their attention to technology as a means for achieving quantum leaps in productivity.

Responding to the challenge, many practitioners are enthralled by the prospect that technology offers. Having access to technology, many will experiment. Government funding has encouraged such developments. The popularity of conferences such as those organized by the UK based Association for Learning Technology reflect both the scale of development and the level of interest.

However, much of the work reported into the application of technology in education is basically experimental, narrow in focus, and limited often to a specific technology applied to a particular situation. This point is made not to criticize the initiators but rather to highlight a broader problem. As Laurillard (1993) points out

> *'Research and development projects on educational media pay quantities of hard cash for development, lip service to evaluation and no attention to implementation. There is never enough to equip a decent program of piloting, dissemination, and staff training that would be needed to properly establish an innovation!'*

Generally within the education and training sector we have not yet started to embrace the notion of applying technology to process re-engineering, either in the management of our institutions or in the teaching processes to which we expose learners. Without a much more widespread change, we may well continue to fail to meet societal needs.

Re-engineering Management Education

The market-place for management education, like the market-place for many businesses, is changing rapidly. The factors bringing about the change include:

1. The restructuring of business & public sector organizations, delayering, and the move away from a 'job for life.'
2. The immediacy of training demands and the need to respond on a 'just-in-time' basis, any time, any place.
3. An emphasis on 'competence to do' as an outcome rather than paper qualifications.
4. Pressures on training budgets leading to an emphasis on value for money and increasing buyer sophistication in allocating budgets.
5. An emphasis on individuals managing their own personal development rather than this being a stage managed by someone in a corporate headquarters.
6. The importance to the individual of the 'cv' and certification of achievement.
7. The rise of 'gurus' and the desire of learners to access latest 'fads' and tools for implementation.

However, any re-engineering effort, to be successful—according to Hammer and Champy (1993)—must start with a clear understanding of mission and objectives. It will then involve benchmarking to assess the degree to which the organization meets world class standards. Following this, a mapping of the processes starting from meeting the customer need can take place. This review then has to be put within the context of the organization and its capability to deliver. This considers not only the technological opportunities but also the skills and supporting culture within the organization.

In looking then at the processes for management development, in order to improve performance, it follows that the starting point is to re-examine the purpose. MacFarlane (1995) suggests that learning

> *'results from the progressive development and refinement of concepts and schemata (the rules and procedures governing action) and leads to the acquisition of coherent frameworks of reasonable beliefs together with the necessary skills to put them to effective use.'*

Implied in this statement is the need to understand the scientific basis for action as well as to be able to apply skills in practice, a theme intrinsic to Kolb's (1984) learning cycle i.e.:

1. the learner moving from concrete experience to
2. observation and reflection to
3. formation of concepts and generalizations to
4. hypothesis to be tested in future actions; leading to completion of the cycle with new experiences.

In relation to the development of managers and their organizations more widely, both Senge (1990) and Argyris (1990) argue the importance of managers moving from 'single-loop' learning to 'double-loop' learning. Senge introduced the concepts of personal mastery, mental models, team learning, and systems thinking in his definition of the much sought after 'learning organization.' In personal mastery individuals develop their learning through a creative tension between their future vision and current reality. Various methods such as meditation, imagery, and visualizations are suggested as helping cope with beliefs of powerlessness and unworthiness which hinder learning. In examining personal mental models, Senge highlights the learning barriers resulting from defensive routines. Argyris (1990) refers to the gap between the managers' 'espoused theories' (what they say) and their theories 'in use' (their mental models). Defensive reasoning arises from high aspirations among 'smart' people and a high fear of failure which may lead to feelings of vulnerability and incompetence. Team learning offers challenges in a supportive environment. Systemic thinking ensures a broader perspective based on a developing understanding of the inter-relatedness of system components, a holistic view particularly in relation to introducing and managing change. Single-loop learning results where individuals respond to changes in their internal or external environment by detecting and correcting errors so as to maintain the central features of organizational norms. In contrast, double-loop learning is where the current organizational norms and assumptions are questioned to establish a new set of norms.

We suggest that it is this 'deep-learning' which is required of management education and development if we are to influence the quality of management needed in 21st century organizations. Such learning does not result exclusively from educational processes as implied in Kolb's learning cycle but is achieved through a mix of experiences.

Technology and Management Learning

Summarizing, we may conclude that we need to:

1. Increase the quantity of provision from existing resources.
2. Improve the quality of 'double-loop' learning.
3. Offer opportunities on a 'just-in-time' basis.
4. Ensure that learning is relevant for the individual and avoids redundancies—'customization based on mass production.'
5. Ensure that teaching is soundly based pedagogically.
6. Ensure that learning is achieved whatever the stimulus for that learning i.e. education/training, work or leisure.

If technology is to be used to good effect its applications must be designed to support the learning process rather than dictating it. It must be used to liberate the learner and increase learner control over the process.

Technologies can be categorized according to their uses/limitations in the learning environment (see Table 1 based on Bang, 1994). The distinction between real time (synchronous) and store-and-forward (asynchronous) is particularly important when looking at the need for just-in-time and student managed learning where students want to decide 'where' and 'when'. Person-to-person dialogue seems particularly important when the focus of learning is 'double-loop' learning because of the need for the learner's assumptions to be challenged constantly and deeper understanding developed.

Table 1. Categorization of Technology in Teaching

Type of interaction	Synchronous	Asynchronous
Person to person dialogue	Tele- & videoconferencing, telephone	Fax, voice-mail, e-mail, electronic groupware.
Person to system dialogue		CAL, delivered on CD-ROM, disc, interactive, video, cdi.
No interaction	Broadcast, radio & TV	Print, audio & video cassettes

The learning process can be mapped as illustrated on the left side of Figure 1. The mapping can be at the level illustrated or in much greater detail. It is then possible to identify opportunities for the application of technology as illustrated on the right side of Figure 1. At this stage functions have been identified rather than specific technologies. Careful identification of potential technologies against process elements can help institutions identify those areas where they can add greater value and develop means for meeting learner needs by buying in the services of others.

Learning Process Map		Application of Technology

Figure 1. Mapping Technology to the Learning Process

At our own institution, the basic delivery medium adopted is the Groupware System, Lotus Notes. This provides the platform from which faculty and educational technologists can commence re-engineering the learning process and focusing on developing a learning environment encouraging 'double-loop' learning. Other applications such as the WWW, CD-ROM based materials, and disc-based simulations can all be integrated. But more importantly it allows for interactivity between tutors and peers. With careful design the possibility exists for group learning leading in turn to individual 'deep' learning. This is also seen as providing for a review of the learning processes.

The Effectiveness of Groupware in Creating the Learning Environment

Recent research at the College has built on earlier work into the efficacy of computer mediated communications (e.g. Kaye, 1993, Mason, 1989, McConnell, 1994). Akehurst (1996), based on questionnaire surveys and usage analysis concludes:

> *'The evidence from the evaluation of the College's case does show that the system has in some instances helped develop and encourage peer support and reduce the transactional distance of the distance learner from fellow students, from tutors and from the providing body. However, it is important to say that it is not the system itself that has generated this effect, but rather the way in which students have been encouraged to use it by their tutors. The most successful use of the system, both from the perspective of the amount of use made of the system, and from the perspective of the students' post-use reactions to it, has occurred with those groups which have had greatest tutor input and support in the use of the system, and for whom the greatest number of specifically designed exercises were made available.'*

One of the key barriers to effective application has been found to be the lack of competence of learners in the use of such systems to go beyond the most basic of communications. But this limitation in understanding also applies to tutors. From a review specifically of electronic mentoring by tutors, Birchall and Houldsworth (1995) earlier concluded:

> *'There is no one accepted definition of the role of mentor... the role requires a range of competencies and many tutors experience difficulties even in a face to face situation. To date much of the mentoring activity has been at the level of information exchange.'*

In contrast, McConnell (1992) reports that the emotional content of dialogue increased as people got to know each other:

> *'Working with emotions in an online environment is a new experience to all of us. We don't shirk from it, but we tread softly because we are unfamiliar with some of the consequences of doing it in this new medium.'*

Until tutors develop confidence and competence in challenging learners in an electronic environment, 'double loop' learning is less likely to occur.

Akehurst (1996) goes on to conclude that students respond differently to differing exercise types e.g. subject tutorials, case study analysis, group work, specialist topic discussion. Clearly their commitment to the use of the system will depend upon the extent to which they see the activity 'adding value' to their learning. Where it is unclear, possibly because of a lack of integration of the work into assessment processes, the student is unlikely to expend energy.

From this we may conclude that in addition to variability in students' aims and objectives, there are significant differences in how they perceive a range of activities as contributing to their ultimate aims. The design of the system needs to provide learner choice so that a fit between expectations, needs, and provision can be achieved (customization based on mass production).

Whilst many aspects of the introduction of Lotus Notes into MBA provision are viewed positively, the example presented falls short of the fully integrated learning experience based on a re-engineered learning process aimed for by the institution and illustrates some of the barriers to full implementation. However, it does represent one step on the route.

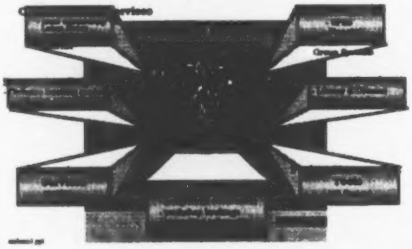
Moving Forward

One can conclude that a major re-engineering of the learning process incorporating high levels of interactive technology is technically feasible. Questions remain about the economic viability for educational institutions but probably, more importantly, organizational acceptability.

Lotus Notes offers exciting opportunities for designing what we have described elsewhere (Birchall and Houldsworth, 1995) as a 'possible model for Henley students' performance support system,' providing the learner access electronically to the tools needed to support the learning process (see Figure 2 for illustration).

Possible Model for Henley Students' Performance Support System

Figure 2



Course content can be made dynamic by feeds from the Internet, interactive exercises can be provided on the workbench, information services can be offered but, more importantly, it can

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offer access to a learning community of peers and tutors. When systems are fully integrated within course design, when they offer user-friendly interfaces and can be seen clearly to enhance learning with benefits exceeding the entry costs (equipment, opportunity cost of developing mastery of the technology, costs in use) students will explore the technology. However, without the obvious presence of course organizers and tutors actively and effectively using the system, it is unlikely that students will perceive the benefits to be other than marginal.

Probably the greatest barrier to progress is faculty. Currently such systems pose a threat to the status quo. New skills and behaviors are required, the frameworks for which are not yet fully understood. Organizations in the main reinforce former behavior with reward systems inappropriate for an electronic age, along with pressures for improved tutor output with minimal support to move to new ways of working.

Building on Laurillard's (1993) statement quoted earlier about problems of dissemination, we would add that small scale demonstrators can also easily become 'encapsulated,' failing to have impact on the wider organization. For the full benefits of development in ITC to be reflected in educational delivery there has to be a major rethink among the stakeholders, pay-masters, institutions' executives, faculty, and customers. Such a rethink may not be possible within existing institutional frameworks.

Conclusions

From both practical experience in developing systems and in researching their impact, the authors are convinced that Groupware, such as Lotus Notes, has the potential for supporting radically new ways of delivering learning opportunities.

Whilst technically feasible, the organizational issues in introducing change present major barriers to re-engineering on a wide-scale. Findings from failures to re-engineer business and public sector organizations echo this conclusion (see for examples Hammer and Stanton, 1995).

If we are to take full benefit from the opportunities a fundamental rethink of processes is required based on clearer understanding of how managers learn and also use technology in their everyday activities. Closer integration of systems as well as methods to ensure more effective learning both through formal processes and through every-day activities would accelerate the adoption of technology in a more radical way.

Whilst we have focused our attention on the education and development of post-experience managers, we believe that the issues raised apply equally within other sectors of education and training.

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Traditional Poster Session

Creating Replicable Technology-Based Lesson Plan

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Key Words: **distance learning, science education, collaborative learning, education technology, computer-based learning**

SCOPE, Super Collider Opportunities for Public Education, is a Texas science education collaborative that is comprised of 10 public school districts and IBM, Apple Computer, Inc., Edunetics, and the Computer Curriculum Corporation (CCC). Through this new project 238,878 Texas children have received the opportunity to practice high tech science, not just observe it.

Dr. James L. Poirot, Associate Dean for the College of Education directs the project that is operated within the Texas Center for Educational Technology at the University of North Texas (UNT). With over $4.5 million dollars in assets coming from the Department of Energy's Superconducting Super Collider at Waxhachie and over $1 million dollars in support from partner school districts, SCOPE is the largest single sponsored project in UNT history.

The University of North Texas serves as the onsite training and operational facility for the collaborative project. In inservice training workshops and seminars, teachers learn to use the science equipment, and full-time instructional staff from the Texas Center for Educational Technology provide operational support.

The collaborative is comprised of school districts from the North Texas area including Allen, Carrollton/Farmers Branch, Denton, DeSoto, Keller, and Plano, as well as partners in Port

Neches-Groves, Fort Bend in the Houston area, North East in San Antonio, and United in Laredo. These districts represent rural and urban areas throughout the state and have student populations that mirror the state's ethnic makeup.

Each of the school districts have a mobile laboratory that includes a cluster of microcomputer systems and educational software. Classrooms are equipped with interactive technology that link students from across the state together as they explore science and technology. Students in Laredo, for example, are able to routinely communicate across hundreds of miles with students in DeSoto or Houston. Every attempt is made to make learning about science a fun experience.

Central to SCOPE's goals are establishing ways for children to interact with practicing scientists. High-level science equipment, computer-based learning tools and interactive distance learning technology allows teachers and students in the schools to communicate on daily basis with science mentors at universities and Department of Energy laboratories throughout the world.

The science collaborative's primary purpose is to create 21st century science initiatives that motivate student interest in lifelong science education, assure SCOPE teachers a world-class science and technology experience, assist teachers in a role shift from "expert" to "facilitator," share state-of-the-art science and technological resources with the SCOPE collaborative, and link the SCOPE communities with government and corporate partners to achieve student success in science.

Staff development on the high-tech equipment, such as cloud chambers, weather computers, spectrum analyzers, telescopes, and lasers has been an exciting experience. As teachers created science experiments and student activities, easy-to-read, replicable lesson plans were written for posting on the SCOPE Web site.

Creating thematic lesson plans that anticipated the questions of future-users was a challenge. At a SCOPE Staff Development Workshop, teacher committees developed the SCOPE Lesson Plan Template to match state curriculum with the experiments and activities using sophisticated science technology. Using professional forethought, they designed specific instructional objectives that could be adaptable to grade levels K–12 and flexible for various classroom environments. Detailed user-friendly directions to teachers explain how to create experiments, student activities, and evaluation exercises.

Successful replication is the focus of the SCOPE Lesson Plan design. Thorough explanation of instrument and experiment set-ups are included along with checklists for materials needed, students roles, and anticipated outcomes. In addition, there are warnings of troublespots.

The SCOPE Science Education Collaborative publishes teacher-developed lessons on their Web page housed within the Texas Center for Education Web site at *http://www.tcet.unt.edu* so that all science educators can work together and share ideas. In order to provide classroom materials that may be adapted to various grade levels, the SCOPE Lesson Plan was constructed to contain abundant information that will any teacher to easily replicate thoughtful instruction at a particular grade level.

SCOPE encourages any teacher to revise a posted lessons or develop new lessons demonstrating ways that the science technology gained from the closing of the Superconducting Super Collider can be used in the classroom. These new lessons can be submitted to the SCOPE Webmaster for possible postings.

Section I

The SCOPE Lesson Plan Format is divided into the following sections: Topic, which is the major category, such as radiation, will help organize lessons and equipment needed in instruction; Title of Lesson which captures student and teacher attention; Grade Level, which encourages teachers to be specific because few science lessons are applicable to K–12; Date Lesson Created which gives a beginning time for a unit; and Date of Revisions which allow teachers to investigate the latest revisions.

Section II

This section should list all the contributors names, school addresses, telephone numbers, and e-mail addresses (if available). Such information will enable teachers who are trying to duplicate the lesson to contact the source teachers who originated the lesson and seek advice or problem-solving measures.

Section III

Lesson Overview: Two or three paragraphs will give the reader a summary of the lesson's content. It should include: overall objective(s) to be covered in the lesson, a brief description of the audience to whom the lesson are addressed, a time frame necessary to complete the lesson methodology being used in the lesson, such as cooperative learning, discovery learning, etc.

Section IV

Lesson Objectives: This brief section will tell the reader if they want to further explore the Lesson. Specific instructional objectives should detail what students are expected to master. It is entirely possible that the section might include several types of objectives. *Behavioral objectives* would describe behavior changes that the teacher expects from students upon the completion of the lesson.

Performance objectives would describe what students are expected to do during the lesson. *Process objectives* would state activities in which students would be engaged during this lesson.

Section V

Specific Audience: The audience for the lesson plan should be stated explicitly. That is, it would be better to describe the audience as "college-bound 11th grade biology students with several years of experience with computer technology" rather than to describe the audience merely as "11th grade biology students." (The general background of students should be included here; the specific skills which students will need to complete the lesson should be described in the "Prerequisite Skills" section of the lesson plan.)

Section VI

Time Frame: The time frame for this lesson should be stated. That is, "one period" or "one week" are inadequate descriptions. This description should include such information as the number of minutes per day needed to complete the lesson. It should also include the amounts of time that might be needed between parts of the lesson. Thus an appropriate description might be:

This lesson requires five 30-minute sessions spread over one six-week period. The first two sessions should be presented on subsequent class days. The third and fourth sessions should be presented at one week intervals after the second, while the fourth session should be presented one week after the third; the fifth session should presented when all students have completed their projects.

If alternative presentation times are possible, then these should also be included in this section of the lesson plan. For example: for older students, it may be appropriate to present the first three sessions on one day with a brief review on the following day.

Section VII

Prerequisite Skills: This section of the lesson plan should describe in detail what skills students should possess before encountering this lesson. This should include the topics that the students have studied previously, vocabulary that is relevant to the lesson, a description of the subject matter background that students need, and their level of knowledge and experience with the technology to be used in the lesson.

This section might include descriptions such as: (1) Students should know a number of strategies used in problem solving, such as breaking problems into small parts and working backwards. (2) Students should have mastered addition of fractions with unlike denominators. (3) Students should to know how to log in to the network and access the school bulletin board.

Section VIII

Materials Needed: This section should name materials of what is needed to complete the lesson in a check-list format so the teachers attempting to duplicate the lesson plan can check items off as they proceed. Both the teacher materials and the student materials should be included.

Section IX

Activities, Time Needed, and Procedures: A detailed paragraph will describe how to carry out the lesson. This will be the longest part of the lesson plan. It should follow a "cookbook format" that will provide even the most inexperienced teacher with the information needed to carry out the lesson successfully. It should include details about such things as how many students should be assigned to groups, how long students should spend on each subactivity, how much material is appropriate for students to produce, what teachers should expect to occur, how to deal with common problems, etc.

Subactivities should include: *Focusing Student Attention*: How teacher focused student attention on a familiar topic to focus attention toward learning a new piece of knowledge or acquiring a skill. *Modeling:* How teacher modeled this new skill or used this new knowledge in an activity. *Check for Understanding:* How teacher determined that further instruction was not necessary and activities were able to begin *Guided Practice:* What activities were used for students to practice the new skills or exercise the new knowledge with teacher-monitoring. *Independent Practice:* What activities were used for students to practice the new skills or exercise the new knowledge with freedom to make errors. *Evaluation*: What activities were used to allow students to demonstrate knowledge.

Section X

Evaluation Activities and Time Needed: Evaluation activities should explain how the children demonstrate knowledge of a concept. These activities can include both formative and summative evaluation schemes. It should address ways in which teachers can determine if the objectives of the lesson have been achieved *by students' demonstration of mastery*. This section should go beyond traditional testing and should give teachers suggestions about how to determine the extent of student learning when exposed to new technology, etc.

Section XI

Teaching Suggestions: This section includes ideas that, while not necessary to the lesson, might enhance the learning or interest of students. Ideas presented often come from the experience of a teacher who has taught the lesson. These ideas could include such things as unusual ways to present material, ways to increase student ownership of the lesson material, extensions into other classes or disciplines etc. It is likely that this section will be added to the lesson plan after a teacher has had some experience with the lesson.

Section XII

Follow-up/Extension Activities: Here the plan should address the ways in which the lesson can become cross curricular. In this section of the plan, ways to follow-up questions or ideas that were "sparked" during the lesson should be discussed. Again, part of this section may only be developed *after* some experience with the lesson. Part of this section might also be left blank for the teacher to add notes as the lesson is taught.

General Session: Society Session/Current/Emerging Technologies (Organized by ISTE)

Internet Resources: Productivity Tools for the Research Community

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Key Words: **Internet, research, digital publishing, electronic publishing, productivity tools**

The methods by which researchers go about the day-to-day business of conducting research (e.g., collecting information, accessing databases, reading proposals, publishing findings) is changing rapidly. Increasingly researchers are turning to the Internet as a source of up-to-date information, data, requests for proposals, and as a means to publish their research findings. Researchers are discovering that the Internet is not only a tool that can facilitate their collection of information, but that it is becoming a method by which they can publish their work in new online electronic journals.

Major links exist on the Internet in all fields—from art and chemistry, to education and medicine. These sites contain large data bases, opportunities to engage in dialogs with other researchers, information concerning requests for proposals, grant management information, a growing number of digital journals (e.g., *Immunology Today Journal, Journal of Contemporary Art, Quanta,* and *Psycoloquy*), and a growing number of popular press publications (e.g., *The Chronicle of Higher Education* and *Wired*). In the area of research we are beginning to experience a movement to merge the informality, speed, inexpensiveness, and power of the emerging technologies (whether on a network, the Internet, or CD-ROM) with the traditions of information distribution, scholarship, and research in the print world.

Research and electronic publication are still attempting to understand the impact the Internet or the World Wide Web will have on how research is formulated, conducted, and disseminated. Discussions of how research and electronic publication are related to the Internet or the World Wide Web are just beginning. It is a very exciting time to be conducting research and to be exploring the power of the Internet to contribute to the research process. It is also a very fluid time in that professional organizations, publishers, other researchers, educational organizations, etc. are attempting to define their relationship to the Internet. It is time for researchers to become familiar with the resources offered by the Internet and to join in the envisioning of the vision of this powerful tool. In this manner researchers contribute to the development of resources on the Internet that they feel will contribute to their research productivity.

Educators must focus not only on the extant possibilities of the Internet for fostering research but also look to the future for the possibilities that ought to be. A set of goals for this discussion among interested educators includes:

1. The emergence of the Internet and World Wide Web as an information source for researchers
2. Resources on the Internet that are available to enhance the productivity of researchers, including the following research phases:
   - designing the study
   - conducting the study
   - analyzing the data
   - reporting the results
3. The history of electronic publishing and scholarly publishing in general
4. Digital publications both on the Internet or on CD-ROM

General Session: New Curriculum Designs/Instructional Strategies

C++ Subset for the AP Exam: Why, What, and When

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Key Words: **C++ language, Advanced Placement (AP) Program, C++ subset, computer science**

A proposed subset of the C++ language was developed as part of the work of an ad hoc committee of computer science educators both at the secondary and undergraduate level. This subset should be appropriate for use in the first two computer science courses. Barbara was a member of that committee which met several times over the course of a year and which has a draft document available on the Web as part of the Advanced Placement Computer Science Program. She will discuss both the subset and the pedagogical reasons that motivated the choice of language construct, as well as the advanced placement program itself.

The subset can be found on the Web at: http://www.cs.duke.edu/-ola/ap/prolog.html.

AP Computer Science and C++
  What is the Advanced Placement program?
  Why is program of interest to high schools and colleges?
  Why an ad hoc committee?
  Who served on it?
  What was its charge?
  What is the current status?

A C++ subset
  Why a subset?
  What should criteria be for subset?

Content of subset
  classes
  properties of language
  stream
  not part of subset

What is the Advanced Placement Program?

A program of the College Board. Founded in 1900, the College Board is a nonprofit, national membership association of schools and colleges whose aim is to facilitate the student transition to higher education. Serving high schools, colleges, universities, students, and parents, the organization is a nationally recognized source of essential programs, services, and information in the areas of assessment, guidance, admission, placement, financial aid, curriculum, and research. The philosophical core of the College Board is its commitment to educational excellence and equity for all students, and that commitment is embodied in all of its programs, services, activities, and concerns.

The College Board's Advanced Placement (AP) Program is available in nearly half of our nation's high schools. AP sets high standards, enriches the curriculum, and provides extensive professional development for teachers. It provides syllabi and a national exam in many subject areas. The scores on these national exams are used by colleges and universities throughout the country (and the world) to award university credit for courses taken at the high school level. Each university decides whether to grant credit for AP courses, and what score on the AP exam is necessary for credit.

The topics to be covered in such courses are available in "Acorn" books, so-called because the acorn is the icon representing the College Board. This book also gives sample examination questions. A new Acorn book for each subject area is prepared each year, generally reflecting only minor changes from year to year.

Why is the Program of Interest to Both High Schools and Colleges?

The course both follows and sets the standard for introductory computer science curriculum in a systematic, and broad-based manner. Both university faculty and high school faculty from across the nation come together to decide matters of curriculum. The examination itself is constructed through rigorous test development methodologies over a period of years and each exam has undergone considerable pretesting on college classes. The AP curriculum and the exam itself can be useful in examining one's own curriculum and goals.

Why an Ad Hoc Committee?

During the Spring of 1995, the Advanced Placement (AP) Computer Science (CS) Test Development Committee announced that a transition would be made from Pascal to C++ for both the AP CS A exam and the AP CS AB exam. This announcement led to much discussion in the computer science community. As a result, the College Board and Educational Testing Service (ETS) established an "AP Computer Science Ad Hoc Committee" to advise the AP CS Test Development Committee concerning this transition to C++. In an effort to reflect a range of viewpoints, this Ad Hoc Committee included two SIGCSE representatives, Barbara Boucher Owens (owens@acad.stedwards.edu) and Henry M. Walker (walker@math.grin.edu).

Current Status

With the advice of the AP CS Ad Hoc Committee, the AP CS Test Development Committee has refined the AP CS Course Description and clarified the change to C++ in several ways. The first offering of the AP CS Examination in C++ will be May 1999. Originally, ETS was considering switching to C++ as early as May 1998. This revised date reflects, in part the strong recommendation of the AP CS Ad Hoc Committee.

Since any transition in language will require significant time for teacher training, acquisition of appropriate hardware and/or software, revision of class schedules, development of class, and related preparation, there is a reluctance to change many other elements of the AP CS Course Description at the same time. Thus, it seems best not to change course content—beyond the programming language—at this time. (As noted in the most recent meeting minutes, however, the AP CS Course Description is being updated and corrected so that it more accurately reflects the current contest of the exams.)

Since the overall C++ programming language is large and complex, a subset of C++ has been defined for use on the AP CS examinations. The current statement of this C++ subset reflects received from the circulation of draft materials. The draft materials were presented at 1996 SIGCSE Symposium to encourage additional comment.

A commentary now is available, adding details about the C++ subset and explaining why a variety of choices were made.

Work has begun on a revised Teacher's Guide for a C++ based AP CS course. Fran Trees of AP CS Ad Hoc Committee will be a principle editor and writer.

Plans are being made for 2 sets of training sessions in the Summer, 1997. These sessions will be intended for AP consultants who give regional workshops to CS teachers, so the leaders of various AP workshops around the country will understand the important elements and issues regarding the change to C++. Note that ETS already has budgeted these training, and various leaders (people who have recently served on the AP CS Test Development Committee) are already talking about specific content and schedules for these sessions.

Additional discussions within the AP CS Ad Hoc Committee and with other groups have explored ways to expand communication within the computer science community.

Who Served on It?

SIGCSE Representatives on the Committee
  Barbara Boucher Owens(owens@acad.stedwards.edu) St. Edward's University, Texas
  Henry M. Walker(walker@math.grin.edu),Grinnell College, Iowa
Other Members
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What Was Its Charge?

What subset of C++ should be used?
  cover curriculum
  future directions
  useful but not used on exams

How Do Teachers Get Up to Speed?

Standard Classes and Libraries
  Straight C++ is too C-like, too complex
  pointers/arrays
  pointers/strings
  use classes (apstring, apvector, apmatrix, apstack, apqueue) to teach, on exam, when programming

  - based on "standard" classes, but safe
- Defining the subset of C++
  - support AP courses, college/university courses, AP topic outline
  - minimize or easily detect common novice errors
  - small, but extensive enough, and safe
  - object-based, not (currently) o-oriented
- Elaboration of the subset—including rationale for choices
  - control constructs, programming conventions
  - overloaded functions and operators
  - const-ness
  - templates
  - increment decrement operators
  - break and return
  - inheritance and streams
  - libraries
  - error handling

General Session: New Organizational Structures

Designing District Intranets to Create the Capacity for Learning Together

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Key Words: **education reform, Internet, organizational knowledge, groupware**

Today's critics of education reform accurately focus their anger at the lack of change in the basic workings of schools, but they are completely wrong about the reason. They believe that educators won't change; the sad truth is they can't change. Peter Senge describes the work setting of schools as so fragmented that whatever the organization learns from its attempts to improve and change can't be sustained. New knowledge about what really works falls through the cracks between isolated practitioners each trying her or his best to make a difference with children.

"Fixing" schools requires people who can respond differently to the daily situations they must address. Today's schools have no capacity for their teachers and administrators to learn together, and thus no capacity to fix themselves. Changes in performance are a consequence of learning.

Without a capacity to support continual in-the-job learning and the translation of that learning into improving the explicit ways the organization works, any changes will remain isolated and transitory. Is it any wonder that the history of educational change has been characterized as random acts of improvement?

Every other kind and size of business is currently engaged in designing, obtaining the tools for, and implementing organizational Intranets. Intranets provide a connected technology infrastructure for teams and projects that enables the knowledge, skills, and learning of individuals to be shared with others in the organization. In this way, advances in individual capacity can be translated into advances and increases in organizational capacity. Intranets can be thought of a learning infrastructure.

School districts, which have a charter for fostering learning, have no technology infrastructure to enable organizational learning. This makes it extremely difficult, if not impossible, for knowledge and know-how of individual teachers and administrators to be translated into increased organizational capacity for the district. Intranets provide a strategic tool to enable school districts to become learning organizations.

This session will explore the ways in which Intranets can provide school practitioners in classrooms, buildings, and across the district and community with what Nonaka and Takeuchi call the "capability as a whole to create new knowledge, disseminate it throughout the organization, and embody it in its services and systems." This organizational knowledge-creation process requires continual interaction between three levels: the individual, the group, and the organization. And Nonaka and Takeuchi, authors of The Knowledge Creating Organization, believe the root of it lies in "the most basic and universal component of the organization—individual human knowledge." The concept of organizational knowledge creation supported by a technology infrastructure enables district administrators to begin to view their districts as knowledge creating organizations.

A new generation of collaboration technologies which provide key components for school district Intranets will be described. These include easy-to-use and maintain groupware to support project teams or the faculty of a school and Web-based tools which create the capability for distributed dialogue among teachers, administrators, parents, and other stakeholders.

General Session: Technology Implementation/Educational Reform

Exploring Women's Careers Via Computer Dialogue

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Key Words: **role models, telementoring, self-confidence, technology implementation, education reform, gender issues**

Abstract

The purpose of this project was to nurture and encourage self-confidence and determination in young women in grades 6–8. Through online dialogues with successful role models in science, mathematics, and computer science these young women explored career possibilities and identified issues that affect women in society. Web site: http://www.wfu.edu/~boydmbet/

Traditional Poster Session

A Beginners Guide to Creating Web Page Graphics

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Key Words: **multimedia, public domain graphics, Web page development, authoring languages, Internet**

This session will cover the basics of locating and using graphics for Web pages. Participants will receive a list of Web sites where they will find JPEG and GIF graphics suitable for Web page use. There will be an explanation of the differences between the two formats and the advantages of each. The Web sites will be rated for their usefulness and originality. The issues of copyright, asking permission, and giving credit will be addressed. Suggestions for Web sites and articles that deal with these issues will be included.

Basic HTML commands for incorporating graphics will be explained. Examples of different ways of using graphics to enhance text and increase visual appeal will be given. Design techniques will be addressed. The use of thumbnails and other time and memory saving strategies will be included. Participants will come away with information and resources to help them creatively incorporate graphics into their Web sites.

General Session: New Curriculum Designs/Instructional Strategies

Introducing Teachers to the Net: What? Where? When? How?

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Key Words: **Internet, staff development**

If your school has recently been connected or soon will be connected to the Internet, how do you go about assuring that all of your teachers are adequately trained to make productive use of networking resources in their classrooms? Questions schools need to answer include:

- What topics do we present to teachers new to using the Internet?
- How do we decide who to train first?
- Should we do the training with our own staff or work with a college or other organization?
- How can we get teachers who are reluctant to use technology excited and interested about using the Internet in their classes?
- How can we make sure that technical issues and computer jargon don't dominate the instruction?
- How can we give teachers ideas on how to develop and implement Internet activities in their classrooms, given the constraints of computer access in our school?
- How can we assure that Internet activities will be curriculum-based?

- How can we keep our children safe when using the Internet and how can we make sure they don't access inappropriate materials?
- Should we obtain and, if so, in what ways, permission of parents before children use the Internet in our school?
- How can we provide follow-up support to teachers newly trained in using the Internet?

As you plan for the Internet training of teachers in your school, you need to consider Internet training content and materials, scheduling of Internet activities, acceptable use policies, and implementation, child safety, management issues—all of the practical things that can make a program succeed or fail. By developing a good training program, you can help assure that the ultimate beneficiaries, the students, will be best served.

The author/presenter, Dr. Sheryl Burgstahler, is Assistant Director of Information Systems within Computing and Communications at the University of Washington. She has taught both teachers and students Internet skills and applications. She is also the author of two Internet training books designed to be used by precollege teachers, both published by Allyn and Bacon, *New Kids on the Net: A Tutorial for Teachers, Parents, and Students* and *New Kids on the Net: A NetWork Sampler*.

Paper Session

Peer-to-Peer Relationships on the Internet: Advancing the Academic Goals of Students With Disabilities

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Key Words: **computer-mediated communication, disabilities, peers, social isolation**

Abstract

This study examines the role computer-meditated communication (CMC) can play in helping students with disabilities minimize social isolation and other barriers they face in achieving academic goals. Subjects are high school students with disabilities. Data was collected from electronic mail exchanges, questionnaires, and focus groups. Results suggest CMC can ease social isolation and advance the academic goals of students with disabilities by connecting them to a community of their peers.

Introduction

Many youths with disabilities do not complete high school (Edgar, 1987; Zigmond and Thornton, 1985, in Moccia, Schumaker, Hazel, Vernon, and Deshler, 1989) and, of those who do, many are poorly prepared to meet the challenges of adulthood (Black and Reiss, 1980; in Moccia, et al., 1989). Young adults with disabilities more often continue to live with their parents after high school (Vetter, 1983, in Moccia et al., 1989) and engage in fewer social activities than their peers without disabilities (White et al., 1980, in Moccia et al., 1989). The impact of this social isolation is far-reaching, affecting not only the quality and quantities of friendships, but also academic success. Fewer young adults with disabilities participate in post-secondary education than do their non-disabled peers (Wagner, 1989). And, of those who begin post-secondary programs, more disabled than non-disabled students drop out of school prior to completion (Association for Children, 1982, in Moccia, et al., 1989).

Peer-to-Peer Support Groups

Educators, parents, and other professionals note that a key to successfully integrating isolated students into academic environments is to create informal peer supports and friendships (Stainback, Stainback, and Wilkinson, 1992). Research (e.g., Ostrow, Paul, Dark, and Berhman, 1986, in Jacobi, 1991) suggests that such social support can prevent stress and act as a buffer from the negative effects of stress, a critical factor during the transition period following high school when a student's structured environment ends and many support systems are no longer in place (Burns, Armistead, and Keys, 1990).

Peers can act as role models; offer friendship, advice, and information; promote a sense of belonging; and empower one another (Stainback, Stainback, and Wilkinson, 1992. Peer support groups provide a diverse blend of people with various skills and needs and give each member opportunities to act as a mentor, "helper" or role model (Byers, Armistead, and Keys, 1990). Students can discover their potential to participate in academic opportunities by interacting with others with similar disabilities who are pursuing academic studies they might have thought impossible for themselves. Peers are often more accessible and easier to find than adult mentors.

However, forming peer support groups for this population can be problematic.

Mainstreaming and small population settings, rejection by their non-disabled peers, and barriers to social activities either as a direct result of their disabilities or through lack of accommodations (e.g., transportation, interpreters, and attendants, accessible buildings) means young people with disabilities often have few friends and limited support from their peers (Gottlieb and Leyser, 1981).

The Potential of Computer-Mediated Communication

Computer-mediated communication (CMC), where people use computers and networking technologies, can connect people separated by time and space who might not otherwise meet. In addition to removing geographic and time constraints, the removal of social cues and social distinctions like disability, race, and facial expression through text-only communication can make even shy users feel more confident about communicating with others. Students can learn in the ways that people learn best—through sharing information with peers, questioning information, verbalizing opinions, weighing arguments, and active learning (Harasim, 1990).

Adaptive technologies allow all individuals to participate in computer-mediated communication regardless of disability. For example, people who are blind can access computers using voice output and those with mobility impairments can use headsticks, voice input, alternative keyboards, and other adaptive technologies to overcome the barriers of the standard keyboard. In addition, many people with hearing and speech impairments can participate more fully in communications electronically than in face-to face interactions (Burgstahler, 1993). The combination of adaptive technologies and network communications has the potential to help overcome the temporal, geographic, and disability-related barriers to establishing peer-to-peer support groups. CMC has the potential to reduce the social and physical isolation experienced by people with disabilities.

The Study

An exploratory study was undertaken to examine the role that CMC can play in helping disabled students minimize social isolation and other barriers they face in achieving their academic goals. The research question guiding the study was: **What social and academic benefits does peer-to-peer electronic communication provide a group of high school students with disabilities?**

Data collected from a computer-mediated peer support project were analyzed. Subjects were high school students with disabilities participating in the DO-IT Scholars Program. A wide range of disabilities was represented in the group, including mobility impairments, hearing impairments, visual impairments, health impairments, and specific learning disabilities. DO-IT (Disabilities, Opportunities, Internetworking, and Technology) is directed by the University of Washington in Seattle and primarily funded by the National Science Foundation. This program works to increase the participation of students with disabilities in academic programs and careers in science, engineering, mathematics, and technology. DO-IT Scholars learn to use computers, adaptive technology, and the Internet; communicate year-round with each other and adult mentors; and access information resources. They meet face-to-face during two live-in summer study programs at the University of Washington, the first lasting two weeks and the second the following year lasting one week.

Research Methods

Research data came from four sources. 3,618 electronic mail messages exchanged between Scholars during 1993–1994 were collected and coded according to the contents of the messages. Participation was voluntary; private messages which participants elected not to copy to the research archive were not included in the study. Results were analyzed to determine the content and general nature of Scholar communication. In addition, two groups of Scholars (in 1994 and 1996; 39 persons total) documented their interest in and use of computers, the Internet, and electronic mail in a survey questionnaire; and three groups of Scholars (1994, 1995, and 1996; 95 persons total) discussed the impact of program activities at the end of each summer session as part of focus groups. Last, 26 parents of Scholars participating between 1993 and 1995 recorded their impressions of the value of computer and Internet activities for their children's development of social, academic, and career or employment skills in a survey questionnaire. The discussion below draws from all four data sources.

Results: Use of Computer-Mediated Communication

The high school students in this study make ample use of their computer and Internet resources. 92% of those responding to Scholar surveys use their computers at least once a week, of which 68% use them daily. One parent noted that her son was "using the computer anywhere from four to seven days a week." Another parent remarked that the single biggest benefit of the DO-IT program to her son was "constant computer use where there was minimal interest before." A good deal of computer use by Scholars involves the Internet. 87% of Scholars surveyed report that they "log on" to their University-provided Internet accounts at least once a week; over half (51%) use their account daily. One Scholar enthused, "It's easy, and fast and you can download things. I use it every day I can…I love to use the computer and everything online. If I had it taken away I think I would go crazy or I don't know what I'd do. I just think this program rocks." A parent characterized "his desire for more Internet" as the most noticeable impact of the DO-IT program on her child.

Scholars use their Internet accounts most often to post messages and participate in discussions on the mailing lists. Most Scholars report that they use electronic mail at least once a week (85%), of which almost 60% use electronic mail every day (58%). They also value this electronic interaction. 95% of the Scholars agree that they "enjoy exchanging e-mail with other Scholars," of which 25 (64%) "strongly agreed." Some representative comments include:

> I really enjoy talking with other kids.
>
> I like having a way to communicate with other students.
>
> It's just fun to talk with people and see how they are doing. I like sharing humorous things with them and telling about my life and hearing about theirs.

Results: Benefits of Computer-Mediated Communication With Peers

Scholars reported in surveys and focus groups that they like computers because they are engaging and fun. However, they more often emphasized that computers combined with appropriate adaptive technology help them overcome some of the physical and cognitive challenges posed by their disabilities and give them access to people and resources through the Internet.

Lessening Social Isolation

More than a third of the Scholars (39%) feel access to the Internet allows them to communicate with people whom they would normally have difficulty interacting with due to their disabilities. For example, one of a pair of quadriplegic students who good-humoredly characterize themselves as the "The Quad Squares" said, "You can still be in contact with them. It's kind of hard for two gimps to get together." Students often made use of this connection to others to get ideas and assistance from those in similar situations. The electronic mail archive contains many messages in which students disclose information about their disabilities and seek solutions to barriers they're facing. One Scholar pointed to the advantages of this kind of communication, "E-mail is easier than writing and quicker and I can do it on my own if I need to, and people ask questions about their disabilities so they can get extra help."

Many Scholars praise other unique capabilities of CMC, including its speed, efficiency, and low cost (compared to calling someone long distance). Typical comments were "...e-mail is a lot easier and it's usually faster and more effective this way to communicate information back and forth to each other," and "I love it because I get to talk to a lot of cool people whenever I want and for free." The ability to reach people across time and space was also emphasized by many in comments such as "I like the Internet so I could contact lots of people in other countries... or out of state," and "I love being able to communicate with people (my friends) from all over." Some particularly enjoyed using electronic mail to make new friends on the Internet, saying, "I like it because I meet new people, " and "You can meet people from all over the place, whereas you couldn't meet them if you didn't have a modem."

These Scholars delight in being able to use the Internet to make contact with new people was echoed in the statements of many others who log on primarily to keep in touch with existing friends, particularly those whom they met by participating in DO-IT. Many Scholars mentioned making and maintaining friendships with other disabled students as the most significant benefit of participating in DO-IT, saying, "I like the fact I have made many good friends with various disabilities," and "Some of them become my close friends. It's good to have friends," and "I love communicating with other DO-IT Scholars... it's so much fun, because usually people with disabilities can be more mature than nondisabled people in certain areas." One poignantly summarized a focus group discussion with this insight—"Just meeting and interacting with others like me has given me the realization that I'm okay."

Since their face-to-face contact with each other is usually limited to one or two weeks during Summer Study on campus, these friendships are largely nurtured electronically. As indicated in the table below, personal messages are the largest single category of electronic mail between

Scholars in the archive (61% of messages providing information and 30% of messages seeking information, a third larger than the next biggest category).

Total Messages (sent June, 1993 to September, 1994)		7,429 messages
Scholar to Scholar Messages	3,618 messages	(49%)
Providing Information		
Science, Engineering, and Mathematics (SEM)		7%
Academic, non-SEM		17%
Personal		61%
Disability		9%
College Transition/Adaptation		6%
Technical/Internet		42%
Other*		33%
Seeking Information		
Science, Engineering, and Mathematics (SEM)		2%
Academic, non-SEM		6%
Personal		30%
Disability		2%
College Transition/Adaptation		2%
Technical/Internet		18%
Other*		11%

(*Messages coded as pertaining to career/volunteer/work; DO-IT activities; or opportunities. Numbers add to more than 100% because some messages were coded in more than one category.)

In their comments, Scholars indicate they are using electronic mail to maintain their connections to each other. "You get to talk to people even though you don't see them that much and they're far away." and "I like e-mail because it allows me to keep up with all the people from DO-IT." These and many similar comments indicate that most Scholars feel a sense of belonging to the DO-IT community and value the friendships made in the group, where they have opportunities to interact with others, offer advice and information, and practice interpersonal skills.

Scholars' parents see the electronic connection to a community of others with shared interests and concerns as important to their children's development. 25 of 26 parents rated using computers and the Internet as "valuable" or "extremely valuable" to developing their child's social skills (an average rating of 4 on a 5 point scale where 1= not valuable at all and 5= extremely valuable). One, who rated "The ability to communicate via the Internet and the ability to find a social connection at home" as the most noticeable benefits of the DO-IT project for her child, summarizes these sentiments. "...the high school years are years of learning about ourselves for everyone, and we [adults and other students] don't make time for kids who are different... they are too busy with their own lives. DO-IT provides an outlet for kids who are "different."

Promoting Academic Success

Scholars recognized that being able to effectively use computers and the Internet are valuable academic skills in themselves. A handful indicated they were planning a career in computing—"COMPUTERS... because that's what field I am entering in," and "I mainly like DO-IT because it is 90% computers and I thought that would help me in my career goals." But many others pointed out that computing skills are helpful in advancing anyone's academic or career goals. For example, 35 of 36 Scholars surveyed agreed that having access to the Internet would help them be successful in college and a career, of which over half (51%) "strongly agreed."

Scholars' parents felt similarly. All 26 parents surveyed rated using computers and the Internet as valuable to developing their child's academic skills (an average rating of 4.3 on a 5 point scale where 1= not valuable at all and 5= extremely valuable), of which over half (14 or 56%) characterized their use as "extremely valuable." For example, one parent noted, "[Scholar name] is really looking forward to getting the printer so he can print out the information he finds on the Web, or when he does school reports."

The interest Scholars express in developing their computer-related skills is reflected in the electronic mail archive by the large volume of messages between Scholars about "technical" matters, including computing and the Internet. In 18% of the messages sent peer-to-peer, a student asked one or more others for technical information or advice, and 42% of the peer messages involved one student providing technical information to another. A single question often elicited multiple replies.

About half (49%) of the Scholars note that access to Internet resources provides a way for them to obtain information which was previously hard to get due to their disabilities. One said, "I like electronic communication because I don't need an interpreter on the Internet or my TTY." Another added, "...one advantage of electronic communication is that you can acquire more information at a time. You do not have to work so hard to write things down while someone is talking to you...since I have all the information coming up on a screen, I can go back and refer to it whenever I need to."

Scholars also use each other as academic resources. One Scholar indicated "I like to communicate with other people to get some information for my research." Another said, "I learn a lot from those people [other Scholars]. I learn about activities that are coming up and I learn more about different electronic resources." Scholars also mentioned "I can communicate with others asking questions about all different issues," and "I like getting opinions from them [other Scholars]."

Eight percent of the archived messages sent by Scholars seeking information from other Scholars, and 24% of the messages from Scholars providing information to other Scholars deal with academic topics. The content of these academic messages between Scholars indicates that these students are assisting each other through computer-mediated communication in much the same way students informally help each other at school, at home or in social settings:

> I have a dilemma. Did you take Chemistry, and if so, where did you guys get the periodic table? Second, did you take Trig? If so, how did you use a graphic calculator? (Exchange between several blind students).
>
> I've got a quick question to ask all of you. Have you read the Canterbury Tales by Chaucer? I have to write an English paper about them, and I'm supposed to decide which character Chaucer chooses for himself... e-mail me with what you think...."
>
> (Message posted to the Scholar mailing list).

They also inspire, tutor, and act as role models for each other by sharing academic successes and talents:

> Government is pretty easy. Last week our teacher had us write a constitution and my group wrote one for the school. He graded the constitutions against one another, and ours got the best grade. (Exchange between two Scholars).
>
> I write programs in almost any language, but my favorite is called Visual Basic. I develop applications for anyone who wants them, but I also like to write educational multimedia applications... if there's anything else I can do, just let me know.
>
> (Response from one Scholar to request from another for help with programming languages).

In summary, peer-to-peer computer-mediated communication through the Internet assists students with disabilities to advance their academic goals by building their computer and Internet skills, giving them access to people and resources previously difficult to reach due to their disabilities, connecting them to a group of peers with information, skills and knowledge to share, and giving them opportunities to act as academic role models and mentors to each other.

Conclusions

This exploratory study suggests that computer-mediated communication can help ease the social isolation and advance the academic goals of high school students with disabilities by electronically connecting them to a community of peers who support each other emotionally and academically. Clearly the students in this study see many benefits to "meeting on the Net." Their experiences suggest that electronic peer-to-peer support groups merit further study.

Questions that could be pursued in future research include:

- How do peer-to-peer CMC benefits compare with those of face-to-face peer groups?
- How can the academic benefits of electronic peer-to-peer group support be optimized?
- How do the benefits of peer-to-peer communication compare with mentor-to-protégé communications on the Internet?
- How do the benefits of CMC compare between students who have different types of disabilities?

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New Curriculum Designs/Instructional Strategies

Tips for Successful Technology Integration: Lessons From Project CHILD

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Key Words: **Project CHILD, technology, computer integration, elementary schools, reading, language arts, mathematics, effective classroom environments**

Project CHILD (Computers Helping Instruction and Learning Development) is an innovative computer-integrated instructional model for the elementary school. CHILD has attained national recognition for its excellent results in helping schools achieve higher standards through the integration of technology. Hundreds of teachers and thousands of students from Florida to California are now finding success with Project CHILD. Project CHILD has been recognized as a program of excellence by the National Diffusion Network.

Since CHILD's original development at Florida State University in 1988, subsequent extensive evaluation research has identified key elements for effective technology integration. These four components will be discussed in the presentation. These include 1) instructional design components which restructure the learning environment; 2) teacher collaboration components; 3) student empowerment components; and 4) support components.

Instructional Design Components

Effective technology integration in the elementary school requires a change from the traditional self-contained, one-teacher, grade-specific classroom. Teachers must focus on either reading, language arts, or mathematics so that as subject experts they can become knowledgeable of appropriate software and how to integrate it into the curriculum. Teachers also need well-developed software curriculum guides to facilitate this process.

Financial constraints on public education limit the number of computers available in classrooms. Since only a few students are able to work on computers during a given period, classrooms must be set up for multiple learning stations. It is important that the entire classroom embraces an active learning environment; otherwise the computer station activities will disrupt teacher-led instruction and computers will quickly fall into disuse.

The Project CHILD model incorporates these essential elements along with other effective instructional practices as follows:

- Primary and intermediate grades form classroom clusters.
- Cluster teachers function as trained experts in a subject specialty.
- Students work with the same teacher team for three years.
- Teachers use research-based materials to plan lessons and coordinate instruction.
- Students work at a variety of learning stations.
- Station activities are clearly defined with Task Cards and are appropriate to students' abilities and needs.
- Teachers designate where students begin working each day.
- The classroom ambiance is supportive, equitable, and risk-free.

☯ Teacher Collaboration Components

The restructured instructional model described above requires that teachers work in collaborative teams. In Project CHILD we call these "clusters." Teachers who now focus on a subject specialty and share students must coordinate their instruction.

The CHILD model has been designed to help teachers learn to work together. Several strategies are built into the system.

- ☯ Teachers work in cooperative cluster teams.
- ☯ Teachers meet weekly for structured planning.
- ☯ Teachers observe students in other classrooms.

✓ Student Empowerment Components

Teachers in an active, technology-rich classroom must learn to share power with the students. As such, they must train the students to handle responsibility. The CHILD model has designed several components to facilitate this process.

One important component is the *CHILD Passport* which helps students set goals, keep records of station activities, become self-regulated learners, and engage in self-reflective behavior.

- ✓ Students are trained in CHILD management techniques.
- ✓ Students set and assess unit goals.
- ✓ Students use *CHILD Passports* each day.
- ✓ Students have frequent and equitable access to computers.
- ✓ Students exercise control over materials and equipment.
- ✓ Students work as partners in cooperative teams.

☺ Support Components

Successful technology integration can only happen when teachers get adequate support from administrators, as well as from parents. Adequate training and resources must be provided, along with maintenance of equipment and periodic software upgrades. Emotional support from parents and administrators is also very important as teachers venture into uncharted waters. Support of fellow innovators is also a support component in the CHILD model.

CHILD builds in a parent support component through the Passport system, so that parents can understand that station work has legitimate academic purposes, not just fun and games. Other support components include the following:

- ☺ The principal provides leadership and support.
- ☺ There is adequate time for collaborative planning.
- ☺ Instructional time is free from interruptions.
- ☺ Parents use the *CHILD Passports* to stay informed and provide input.
- ☺ Teachers network through newsletters, e-mail, and an annual mini-conference.

A final tip for successful technology integration is to be patient and persistent. Change is a slow and difficult process. It takes about three years to see significant gains in test scores, although improvements in discipline and on-task behavior are usually immediate. It takes committed and hard working educators willing to break with tradition and move toward tomorrow. Once they begin the journey and experience the positive results, they never want to go back.

General Session: Exhibitor Presentation/Technology Implementation/Educational Reform

Knowledge Forum: An Application to Promote Knowledge Building in Classroom

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Key Words: **knowledge building, collaboration, network, Internet, communal database, cognitive research**

Although schools are instituted to foster learning, classroom research indicates that knowledge and learning are not usually the overt focus of classroom activities. Instead, the focus is on doing schoolwork. Learning is a by-product. This indirect approach to building knowledge can work reasonably well, but is poorly suited to the emerging information age, in which people are expected to work directly with knowledge.

> *"Knowledge building—the creation of knowledge as a social product—is something that scientists and scholars and employees of highly innovative companies do for a living and something that could also be a significant activity of schools, though it is rarely seen there."*[1]

Knowledge Forum, a newly released program based on research at the Ontario Institute of Studies in Education and on an earlier product called *Computer Supported Intentional Learning Environment (CSILE)*, aims to put knowledge at the center of classroom activities rather than leaving it as a by-product of schoolwork.

> *"The central purpose of* Knowledge Forum *is to make such knowledge building an integral part of schooling. In order for this to occur, the character of classroom discourse needs to undergo radical change.* Knowledge Forum *has been designed as a computer-supported environment in which collaborative discourse is the primary medium for knowledge advancement. Students identify and pursue issues of understanding and engage in the kinds of dialogue used by workers in the sciences and in other dynamic, knowledge-advancing organizations."*[2]

In order to meet this major challenge the problem has been viewed from three levels:

- The Research Level: *Knowledge Forum* and its predecessor *CSILE* have grown out of a decade of research on knowledge-telling and knowledge-transforming processes in writing, intentional learning, and expertise. This research has highlighted the importance of students' own goals in learning and has demonstrated ways to get students to focus on knowledge building rather than on school task performance. Along with other contemporary cognitive research, our research emphasizes the importance of classroom discourse and building an intellectually supportive classroom culture.
- The Software Level: At the center of the *Knowledge Forum* software is a communal database. All students have access to this database via a local network and other databases (if allowed) over the Internet. Notes, which include text and graphics, in all curriculum areas are entered into the same database, where they can be accessed through searches using keywords, problems, author, or other note attributes. Students may build-on or reference each other's notes and authors are notified when comments have been made. All features, however, are intended to enhance the potential of the communal database for collaborative knowledge building.
- The Classroom Process Level: This is the level at which research findings, software design, and teaching expertise come together. Even though, in current implementations, students

spend only about a half-hour per day on *Knowledge Forum*, *Knowledge Forum* activities do not stand apart from the regular school program in the way that computer activities usually do. When offline, students are planning knowledge-building projects, seeking information from a variety of sources, and engaging in whole-class and small group discussions of questions, ideas, and findings. When online, students are entering and following the plans, entering new information through text and graphic notes, and carrying on more pointed discourse on questions, ideas, and findings. Constructive commenting is a heavily-emphasized skill that the public nature of *Knowledge Forum* communications strives to encourage.

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Paper Session

Laptop Computer Use for Communication by Students With Severe Disabilities

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Key Words: **severe disabilities, communication disabilities, laptop computers, inclusion**

Abstract

Project FIT (Full Inclusion through Technology) was undertaken to determine the extent to which laptop computers might provide communication opportunities for students with severe disabilities and, specifically, to augment their interaction with peers in inclusive settings. This paper outlines training interventions, system designs, and results for a sampling of three subjects from the project.

Project FIT (Full Inclusion through Technology) was undertaken to demonstrate and evaluate the benefits of educational innovations using technology. At the outset we chose to focus on students with severe cognitive and other disabilities and to limit our technology evaluation to laptop computers, specifically Macintosh PowerBooks.

Participant Selection

The three cases described in this paper were part of a larger study of 14 students in school districts across the Pikes Peak region of Colorado. The school districts serve an ethnically diverse population. Instructional delivery systems for students in special education include segregated classrooms, resource rooms, and schools where students spend virtually all day in regular education settings.

Our initial solicitation procedure was to send a letter to the Pikes Peak Region Directors of Special Education to solicit nominations for potential inclusion in the study. The letter solicited nominations of students with severe cognitive and other disabilities generally with IQs, if measurable, of below 40 and who had concurrent deficits in adaptive behavior. Also included in the target group were those students who had such physical and behavioral characteristics that they generally fell below the fifth percentile in daily living, social, interpersonal, and/or vocational performance.

The research directors traveled to each of the 28 sites to interview students, teachers, and educational assistants to gather information on student needs and current technologies, and develop a general profile of the students' abilities and disabilities. The ultimate selection of the students was based on student profile (a mix was desired), teacher willingness to participate in the study, and parent consent. No disqualifying criteria were applied.

General Protocol Development

Development of instructional programming generally consisted of four phases: in-depth assessment, meeting with the student's team, instruction including initial baseline, and training of parents and educators at the end of the semester.

During in-depth assessment, the team sought to determine type and location of input devices, method of input, and type of output desired. Concurrently, we worked with occupational, physical, and speech therapists to assess whether the students were going to use their head, eyes, fingers, feet, etc. to operate input devices. We also had to assess what would be the best type of output. We used visual, voice, and environmental control output during our study.

Arguably the most crucial phase of development was a team meeting where the results of assessment were presented and the team, including the parents, made final instructional design decisions. During these meetings the content of the communication program would be decided, presentation methodology would be discussed, and scheduling decisions would be made. The teams were encouraged to and generally did develop communication content that was functional and immediately useful to the students.

Training generally followed an A-B design. In several cases we used a multiple baseline across input devices in conjunction with an A-B design. We generally used a mand-model procedure coupled with either least to most prompting or most to least prompting, depending upon the student and the training.

Instrumentation

Our data collection methodologies were unremarkable. We developed a File Review Protocol to gather information pertinent to the design of a system for each student. This was done with permission from the parents and the school.

We used event recording to collect independent and prompted responses on common handmade data collection sheets. These data were then summarized and converted into time series graphs. We collected interaction data using a partial interval procedure with intervals of one minute. We collected 30 minutes of data per student per day. A coding scheme allowed us to record a variety of types of interactions so that we could analyze both student initiated and other initiated interactions.

The Case Studies

The next sections present briefly our work with Bethany, Cathy, and Darla (not their real names). We selected these students because of the similarity of their results and because post-project information reveals continued improvements in their ability to communicate. It is our hope that practitioners can glean some insight from reading the case studies and examining the data on each student.

Bethany

Bethany was seven years old when we met her. Despite the serious physical challenges imposed by cerebral palsy, Bethany operated a motorized wheelchair and at home, she crawled or "walked" on her knees to get around. She was in good general health, and had recently learned to feed herself. Her receptive speech was assessed at about 4–5 years, but her expressive speech was limited to about 1–2 years, and intelligible only to her parents and teacher.

At school, Bethany was included for 1.5 to 2 hours a day in second grade academics. She worked with an *Intro Talker*, a device that her teacher programmed each morning so that Bethany could participate with her resource room group in answering questions about the date and weather. Once a week, Bethany received services from an occupational therapist, a speech therapist, and a physical therapist. On alternate Fridays, she participated in adaptive physical education.

Bethany's use of the *Intro Talker* was limited, although she was clearly able to pick out the picture symbols on the keyboard. The device was on loan, and was not available for her use at home. Her IEP (Individualized Education Plan) stated that academic goals included an increase in expressive and receptive language, and learning lower case letters as well as numbers up to 20. According to Colorado guidelines, she had been identified as having cognitive disabilities in the severe range.

Assessment and Design

Although Bethany did not exhibit a full range of motion, we observed her competence in using a joystick to maneuver her power wheelchair. We thought that she could utilize a PowerBook laptop computer using standard input devices, so we began to assess her use of a mouse, a joystick, and a trackball. Bethany was given a computer screen with four choices. The four choices were represented by icons. Bethany could "ask for help," "ask to go to the bathroom," "ask for something to eat," or "ask for a drink" by pointing to the corresponding icon. A digitally recorded voice then spoke her choice.

At each assessment session, she was given 15 opportunities to use one of the pointing devices (mouse, trackball, or joystick), alternating randomly among the three devices. Baseline data were gathered by modeling the correct response for Bethany and giving her an opportunity to use a device to imitate the response.

Training began after data showed stable results for eight days of trials. The trainer provided the least intrusive prompts possible, from simple verbal prompts to hand over hand training. After only a few day, Bethany's accuracy with the mouse device rose to 100% of the 15 opportunities with verbal prompts (see Figure 1). Clearly, she was a good candidate for using a mouse with a PowerBook computer. Since the mouse is a standard piece of equipment with computers and required no adaptations, we felt that this cost effective means of providing input to the computer holds promise for students like Bethany who utilize the computer for communication.

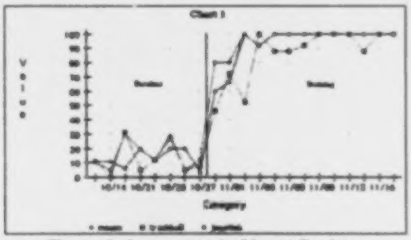

Figure 1. Assessment of Input Devices for Bethany

The placement of the computer was our next challenge. The standard wheelchair tray that she had would not accommodate a computer without dominating the space she had for objects on the tray. We investigated the use of a lightweight Plexiglass tray, but were warned by vendors that the static buildup could interfere with the proper functioning of the computer. We opted for a custom wooden tray, and emphasized the need for an attractive tray that could easily be transferred, computer and all, to the table top at school and at home.

The next problem was a power source to run the PowerBook. We spent several weeks assessing the feasibility of batteries and chargers. None of the batteries we tested could guarantee more than three hours of power—a result that was less than acceptable given the length of the school day. We eventually purchased an adapter that would allow Bethany's computer to draw power from her wheelchair battery without significant impact on the wheelchair's power. The only drawback to that design decision was the need to have her wheelchair near the computer when she used it at her desk or table.

The Intervention

We began working with Bethany on custom software designed to provide two levels of menu choices on the screen. She progressed quickly from four to 16 menu choices. For each of the four menu choices she had mastered, a click of the mouse led to a new screen that held the corresponding submenu. For example, if Bethany selected the "help" icon from the main menu (Figure 2), the screen changed to four new choices including (from top left, clockwise) "Help, my wheelchair is stuck," "I'd like to get into my wheelchair," "I want to get out of my wheelchair," and "I don't feel well" (Figure 3). Additionally, the center of each submenu screen was labeled "Oops," in case Bethany had arrived at an incorrect submenu. Clicking on "Oops" allowed her to return to the previous (main) menu.

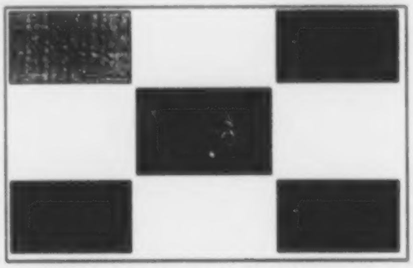

Figure 2. Bethany's Main Menu

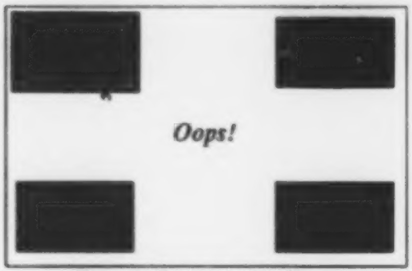

Figure 3. Bethany's Help Menu

A year after we began our initial work with Bethany, we found *Speaking Dynamically™*, a software program that allowed us to provide an almost unlimited number of icons. Those were supplemented by our project staff with digitized photos of family members (including the family pet), and with the digitized pictures of the sleeves of all her favorite videotapes. Many of the usual icons representing common verbs and nouns were available from another piece of software called *Boardmaker™*.

Discussion

Bethany's mother worked closely with project staff to continue increasing Bethany's menu choices, and thus, her ability to communicate. She did this by learning to use *Speaking Dynamically* and program an increasing number of menu choices. She also used the advanced program features to coordinate Bethany's communication with her school curriculum. Before long, Bethany had letter and word choices as well as number screens that allowed her to progress in learning reading and mathematics. Bethany's mother reported that her verbalization did not, as we had feared, decrease with use of the computer. Instead, Bethany grew to associate her communication with the fulfillment of her needs and requests, and she increased her use of pointing and verbalizations to further augment her communication both at home and in other settings.

We tracked Bethany's interaction with peers in regular education classrooms by recording the percentage of her interactions with peers over thirty 1-minute intervals. During the baseline phase, Bethany interacted with peers in an average of 65% of the 30 intervals; after training, this interaction rose to an average of 69%. We also observed the percentage of interactions that were initiated by Bethany. During baseline, Bethany initiated interaction in an average of 42% of the intervals. During training, the average percentage of intervals during which she initiated interaction rose to 56%.

Our work with Bethany ended after one semester, so we had approximately 10 weeks in which to set up her system, gather baseline data, provide training, and increase her choices. The point at which she moved beyond 16 menu choices came in the semester following the initial intervention, so that data on her levels of interactions and initiations are not available.

Cathy

Cathy was a member of our second cohort of students. She did not utilize a wheelchair, but walked with a stilted gait, and was able to independently walk and go up and down stairs. Her cerebral palsy interfered with her full range of motion, but her physical therapist was working with her on using her right hand in a functional way. Recent surgery had corrected a drooling problem.

At school, Cathy spent much of her time in the resource room, although she was a regular participant in a sixth grade classroom. At 11 years old, Cathy was fond of going to restaurants and the grocery store, although she had not yet learned to understand money transactions. She had lunch with regular education students, and assisted with pushing a peer's wheelchair down the hall to the lunchroom.

Cathy showed considerable understanding of spoken language by following directions well. She rarely initiated interactions with others, although she was able to chain two icons on her *Intro Talker* device to communicate an idea. She was able to shake her head and nod to indicate "no" and "yes" and spoke a few words, although too quietly to be understood most of the time. Her signing ability was limited to imitating signs initiated by others. Her teacher said that she would, "stare and hope people would look" when she had needs to express.

Her teacher hoped that the computer would offer a greater variety of communication options than the *Intro Talker*. Besides initiating conversation, Cathy's IEP indicated a need to learn numbers, colors, names, and to make decisions about activities. Most of all, her teacher wanted her to participate in small group interaction with regular education peers and share feelings, opinions, and ideas. One of her proudest moments was a sixth grade activity in which Cathy used her *Intro Talker* to communicate information about Germany (her aide's home country). Her teacher wanted to be able to easily replicate that type of participation.

Assessment and Design

Because Cathy was fully ambulatory, we wanted to find a way that she could transport her computer everywhere she went, including home. Although laptops are conveniently transportable by fully able individuals, the seven or so pounds of weight could easily topple a small 11-year-old. Early experiments with a shoulder bag showed that Cathy was strong enough to make her way around school hallways and up and down stairs without too much difficulty. To protect the computer as much as possible, we purchased a computer "wet suit" to protect it from the elements. This carrying case was functional, since it allowed Cathy to immediately turn the computer on after unzipping the case and lifting the lid; she did not have to actually remove the computer from the case to set it up for work.

We also tested Cathy on a number of input devices: the keyboard, mouse, trackball, and three types of switches. She performed at a 90 to 100% level on 10 trials for all the devices. Since the trackball was built in to the computer we would eventually use with Cathy, this is the input device we chose.

The Intervention

Each of Cathy's baseline and training sessions consisted of 15 opportunities to select a screen icon corresponding to a verbal request from the trainer. During Phase 1 of her training, Cathy had four choices on-screen: "Hi, my name is Cathy," "May I please have something to eat," "Please leave me alone," and "I agree with that." Figure 4 shows clearly that Cathy had full mastery of these skills over seven consecutive days before we moved to the next phase of training.

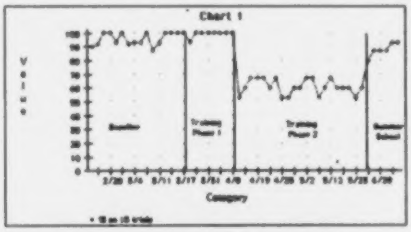

Figure 4. Cathy's Performance Data

During Phase 2, Cathy was given 16 menu choices. Her main menu contained four choices: hello, feelings, food and drink, and yes/no. By clicking on the correct menu choice, Cathy could access a submenu for each category. The "hello" submenu contained "My name is Cathy," "Hi, Mrs. Davis (her teacher)," "I'm glad to see you," and "Hi, Mom!" These submenus increased the level of complexity, since Cathy had to determine which of the submenus contained the requested icon. Each submenu had an "Oops!" icon in the center, similar to Bethany's.

By the end of the semester, Cathy had not reached full mastery of her 16 menu choices. Her teacher requested that the trainer assigned to Cathy continue his work with her through summer school. Although the trainer was unable to meet Cathy every day, the training during summer school proved beneficial as she achieved levels above 90% during that time. The teacher also deemed it beneficial to have Cathy continue over the summer to prevent the possibility that she might forget all of her training if the computer was not used regularly with family members.

Discussion

Cathy clearly had a good grasp of the purpose of the computer for communication. However, like most of the subjects, access to augmentative communication did not immediately result in an increase in interactions, particularly those initiated by the student herself. It became obvious that the amount of time needed to effect an increase in student initiations corresponded to the amount of time needed to integrate the computer into a naturalistic setting for communication. In other words, we can expect that students with severe communicative impairments might take a full year or more to begin to use the computer to actually make requests and initiate "conversations" with peers and adults. All of our subjects depended on adults around them to set up opportunities for them to use their new communication skills.

Darla

Darla was another student with cerebral palsy. Although this disability seriously impaired her physical movements, all members of her team agreed that her cognitive ability appeared normal. Darla used a wheelchair for mobility and seemed to spend most of the school day in it. She had some limitations to her hand movements, but had good head and eye control. Darla wore glasses and had normal hearing.

Darla was fully included with her peers for 80% of her time at school. She participated in a 2/3 split grade class for all of her academic subjects. She almost met with an augmentative communication specialist for an hour each week and was in adaptive physical education two or three times a week.

Darla's primary need, and the reason for her referral to this program, was for a means of communicating thoughts and ideas. She was able to move her head up or down to respond "yes" and "no." She was not able to use sign language because she did not have sufficient arm and hand control. Her teacher stated that she thought Darla recognized words and might be able to read; however, without some type of technology, they were unable to assess this ability precisely.

Up to this point, Darla had participated in language arts classes by working with an aide who would help her compose ideas using what her teacher called a version of "twenty questions." By responding to yes and no questions, Darla was able to communicate to her aide what she had done on the weekend, the arrival of a new baby sister, a ski trip, etc. She was able to count and had started working on addition problems. Darla appeared contented in the classroom and loved to interact with other children. Her teacher regularly arranged opportunities for interaction.

Darla's IEP goals for the semester in which we began working with her included: improving communication skills for academic and social development; developing academic abilities; improving functional and mobility skills in the classroom; and exploring emotions and coping skills.

Assessment and Design

We hoped to capitalize on Darla's many abilities in the design of a training program. She caught on very quickly to instructions, and assessing her ability to use various input devices was easy. Since she did not possess the fine motor control needed for a keyboard, we assessed her ability to use a variety of switches. She showed the greatest control over a head switch which she activated by moving her head slightly to the right. Darla had long, thick hair that sometimes got caught in the switch, but she reacted to this problem with humor. Eventually, her mother had her hair cut, so this problem virtually disappeared.

During the baseline phase, we assessed Darla's ability to select from a menu of four choices during a scan. When the trainer requested a particular icon, Darla waited until that item was highlighted on-screen then activated her head switch. The data in the chart in Figure 5 indicate that she achieved mastery immediately.

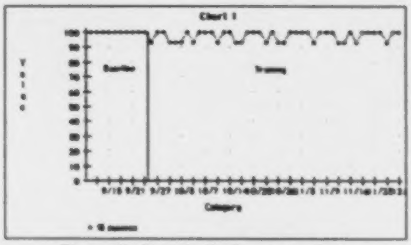

Figure 5. Darla's Performance Data

The Intervention

We added another 16 menu items to Darla's program. Each of the four choices she began with became main menu items, and selecting any of these choices led to a submenu of choices (similar to Bethany's). Darla exhibited immediate mastery of the new menus. We continued to add menu choices after Darla had achieved 100% scores for at least three consecutive days.

Darla's levels of interaction with her peers remained high throughout our observations during the semester in which we worked with her. We had hoped for an increase in her initiations of interaction. Figure 6 shows that, although she rarely initiated communication in more than 10% of the observation intervals (30 intervals of one minute), she did show a marked increase in initiation in the latter part of the semester.

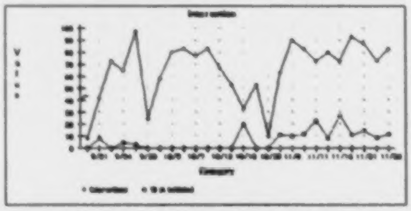

Figure 6. Darla's Interaction Data

Discussion

Darla's progress was outstanding. A follow-up discussion with specialists and teachers in her school district revealed that in the six months following our intervention, Darla used her computer for all of her academic subjects. She is using the computer in reading and writing, history, and mathematics. At the end of the semester in which Darla received training, she was included in a school play. She was able to use her computer with its recorded voice to welcome attendees and introduce the play. She received enthusiastic ovations, and many in attendance were deeply moved by her performance.

Darla's aide learned to operate *Speaking Dynamically*, and is keeping up with the programming changes that keep Darla's system consistent with the content of her academic program. Thus, Darla is able to keep up with her peers and participate actively in class.

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Conclusions

A sampling of three individual cases is not intended to imply that the use of computers will benefit all students with severe communicative impairments attributed to cerebral palsy. We have presented these cases in the hope that the strategies used in designing training and systems, selecting software, and placing devices might be useful to technology specialists engaged in finding solutions for learners who could potentially benefit from the use of off the shelf, portable technology. Technology solutions for people with disabilities are available, but the costs of these specialized devices tend to exceed the cost of general purpose computers, and the software solutions tend to be more affordable than the hardware solutions.

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Paper Session

Teacher Net: Building a New Cadre of Technology Using Teachers Online

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Key Words: **telecommunications, teacher training, teacher peer support, classroom resources**

Abstract

The concerns of the 21st Century are Global ones; the generation in our classrooms today must learn about, explore, and discuss these problems not only with one another but with their peers throughout the world. The Internet makes this type of dialogue possible in every classroom in the U.S. European Schools are well on their way to this goal as well. In order to make this a reality in every classroom in the United States the teacher in each classroom much be knowledgeable and a user of technology; TeacherNet makes this happen in the preservice phase of teacher training.

> *"Electronically networked environments expand the possibilities for what productive communities can produce" (Scardamalia and Bereiter, 1996).*

YOU HAVE MAIL! The message flashes on my computer screen.

It may be from one of the 90 reading methods students I have online or the student teachers that I communicate with daily. They know that they have university support at their fingertips. Being a part of this electronic support community ends the isolation of classroom teaching. These teachers are eager and willing to create the classrooms of the 21st century. All are participants in the California State University, Long Beach TeacherNet program. This group of preservice teachers communicate via Internet about lesson ideas for their classrooms. If one has a problem it is shared with peers as well as university supervisors and mentor teachers. This article describes a unique new avenue of support beginning in the early part of teacher training and then continuing during the important first years of teaching. This type of program nationwide would greatly enhance the development of technology using teachers that our schools need. Connecting these new teachers to the information highway gives them access to resources, membership in a community of learners, and hopefully will help us keep good teachers in our schools.

Some of my students are on SprintLink, some on AOL, some even have their own server! This is the 21st century generation. A survey in USA today reports that when interviewed about the future, young people born after 1971 say that by the year 2000, 59% of us will be getting our news from the Internet.

Seven years ago, I started a project to get student teachers online at a time when there was not much information there to find; today using the Worldwide Web teachers have a resource of information to use in their teaching that knows no bounds. The pressing issue now is to get the nation's classroom's wired and the new technology using teachers graduating from our universities into the classrooms. It is critical that we do this fast for the 5-year-olds that have been home working on Dad's or Mom's CD-ROM will be entering the school doors soon. Will the teacher who meets them be technology literate or not? It is up to us to make it happen.

The Problem

Student teaching has consistently been identified as the most significant element in the teacher preparation process. (Gyyton and McIntyre, 1990). It provides a great opportunity to apply theory to practice in a more intense and prolonged situation than any prior preparation experience. However, distances to travel, last minute schedule changes, and other logistical problems often greatly limit that amount of communication and coaching that has occurred between university supervisors and student teachers. This project has focused on whether telecommunications can improve university supervision.

TeacherNet, is a program designed to integrate technology use during the student teaching phase of teacher training. Piloted at California State University, Long Beach in 1989 with funds resulting from an Academic Computing Enhancement grant, the effectiveness of using telecommunications to improve support and communications between university supervisors and student teachers was studied. The purpose of this paper is to report project accomplishments and talk about future needs for technology in teacher education.

Background

In l984, the Curry School of Education at the University of Virginia, under the leadership of Glen Bull (Bull, Harris, Lloyd, and Short, 1988) created the Teacher-LINK system to connect student teachers in the field with their university professors and improve communications among inservice and preservice teachers. Katherine Merseth (Merseth, 1990) launched her BCTN, Beginning Teacher Communications Network at Harvard in 1987 to provide electronic support to beginning teachers during their critical first year.

In 1989, TeacherNet was created at California State University by Jean Casey in order to improve the student teacher experience, increase the interaction between faculty and students, and enrich the quality of supervision and support. In these past nine years, we have learned a great deal about the efficacy of using telecommunications for support.

Current efforts in increasing support for new teachers focus on the "teacher-induction" period of the first three years of teaching (Merseth, 1990). Other research has concentrated on the use of telecommunications as a means of providing support for preservice teachers (Bull, Harris, Lloyd, and Short, 1989) Whether telecommunications support decreases new teacher attrition is unknown at this time. However, electronic networking between preservice teachers, university supervisors, and beginning teachers appears to enhance the student teaching and induction period experiences. (Bull, Harris, Lloyd, and Short, 1988, Casey, 1989, Casey and Roth, 1992, Merseth, 1990, McIntyre and Tlusty, 1993).

Methodology

The pilot project began in September, 1989 and involved the researcher, six student teachers, and six master teachers. Funding came from an Academic Computing Enhancement CSU grant as well as the loan of 15 Macintosh computers from the Apple Computer Company and 15 donated copies of Microsoft Works software. The pilot project lasted for a year and was evaluated by an advisory board. A report was written by the director, it summarized qualitative data gathered through the use of questionnaires and observations. A video of the project was made. The video details all information needed to replicate this project. The following year additional elementary and secondary university supervisors were trained and the number of students served increased. The next semester an additional 20 IBM computers allowed us to expand this program to include a cohort of Beginning Teachers enrolled in a Curriculum and Instruction Masters Program.

The project continued with original equipment until Fall, 1993 when the advent of new CORE communication software rendered the Mac Plus computers we were using obsolete. At that time the California Technology Project provided the loan of 10 notebook computers. To date we have trained and served over 320 elementary and secondary student teachers, 30 beginning teachers, over 40 master teachers, 15 principals, and 30 university supervisors and administrators. Training initially occurred at a university facility however when funding forced the closure of the lab the project director conducted the training in her own home and then later in a new campus location.

Master teachers were trained along with interested principals at their perspective school sites. A study was conducted in Fall of 1993 pertaining to the amount and types of communicating that the student teachers did. It was found that using telecommunications, student teachers communicated with their university supervisors during this period more frequently than had ever occurred in the previous 18 years without telecommunications. Their electronic messages allowed them to avoid the "phone tag" syndrome where access is elusive and frustration frequently results. By using the electronic mail or conferencing system, messages were directly communicated or easily left for response at the convenience of others. Increased communication was not the sole advantage.

The added time to respond to messages, reflect on the day's teaching events, and formulate appropriate questions was noted in the quality of the types of communications written by participants. The previous semester the university supervisor and master teachers had used written journals for three-way communication with student teachers, but since the journals were written only during the hectic school day, the type of reflection found on the electronic messages, which were written in the quiet of the evening, did not occur. Casey and Vogt examined the two semesters worth of student teachers communications to determine whether or not telecommunications promoted reflectivity. They found that telecommunications definitely promoted reflectivity in student teachers (Casey and Vogt, 1994). Also without telecommunications, the student teachers' peer contacts were often limited to conversations in the teachers lounge; however, with telecommunications, there was evidence of considerable idea sharing with each other.

One of the key advantages for the university supervisor was the ability to schedule visitations at prime times and avoid a long-distance trip to a site only to find out it was the day for a fire drill during that visitation time. Without this type of communication system, much supervision time is wasted.

Other forms of support emerged in the project as well. Student teachers put their lesson plans on their computer using Microsoft Works word-processing and transferred these via communication software and modem to their university supervisor and master teacher for feedback and consultation prior to lesson delivery (Casey and Roth, 1992). All of the student teachers indicated that their participation in TeacherNet had positively contributed to their student teaching experience. Further benefits described in the study include team building, taking care of business and sharing ideas (Casey and Vogt, 1994). Student questionnaire data has been gathered each semester and forms the basis for an ongoing longitudinal study of the graduates of the TeacherNet program.

Findings

Through the use of telecommunications during student teaching, the following benefits have been reported:

1. Increased reflectivity. Students in all studies reported increased time to reflect on what they were learning, including teaching approaches and decision making (Casey, 1989)(Casey and Vogt, 1994).

   Use of e-mail writing helped foster probing to promote deep understanding of teaching, to engage in a written conversation about experiences associated with their making meaning of teaching (Casey and Roth, 1992) (McIntyre and Tlusty, 1993 p.18).
2. Increased feeling of rapport with and support from the university supervisor, access to other supervisors and university personnel (Casey and Roth, 1992).
3. Increased team support, decreased feelings of isolation. Perhaps the most notable outcome of the e-mail approach is the immediacy with which students can establish contact with the university supervisor or their peers or master teacher. No longer do they have to call for an appointment or wait until the next seminar class to address concerns, questions, or ideas (Casey, 1989, Casey and Roth, 1992) (Moore, 1993).
4. Increased self-esteem due to mastering technology and receiving positive support through e-mail messages, increased pride from the professional documents they could create at home (Casey and Roth, 1992).
5. Increased knowledge and use of information access and retrieval as well as various types of technology, such as multimedia (Casey and Roth, 1992).
6. Increased use of the computer at home for personal and professional work and in the classroom when teaching (Casey and Vogt, 1994).

Clearly, certain aspects of support that are enhanced by on-site collaboration cannot be reproduced by an electronic network. Compassionate looks, deep sighs, and other forms of "body language" that often help to tell a more complete story do not translate well on a computer screen. On the other hand, the network offers an at-distance forum wherein beginning teachers can discuss "problems" they encounter in their daily work (Merseth, 1989). The fact that the network is available 24 hours a day is a strength only this technology can offer and when combined with good on-site support greatly improves the quality of supervision in teacher training is improved.

Transition to Classrooms

A critical question posed in early research was, "Will teachers trained with e-mail access at home become computer using educators in their classrooms?" (Casey, 1989). In order to facilitate this transition into the classroom this past semester, student teachers were required to bring a computer with a talking word processor into their classroom, and use it with their students. This means that they were introduced to the computer, used it for their learning, and now had to introduce it into the classroom to enhance their students' learning. This completed the teaching learning cycle. As classrooms become equipped with phone lines then student teacher's will be able to introduce their students to appropriate kids networks.

By the time these student teachers completed the program they were skilled Internet users and were aware of how to access information and collegial support through technology for their school and personal needs. They also had introduced the technology to their own elementary or secondary students in the classroom thus proving their own expertise with the technology. These student teachers were all eager to have telecommunications in their own classrooms (Casey and Vogt, 1994). Future longitudinal studies should report if this is a lasting effect.

At the present time we are expanding our online requirements to include students in their methodology courses, with a future goal of getting every student online at the beginning of their university career.

Conclusions and Implications

Presently I have been using e-mail with student teachers for over seven years. Sixteen semester groups of student teachers have participated in the TeacherNet program. The numbers of university supervisors online has increased, the information resources available on the Internet have exploded and services such as news groups allow groups of teachers or students to discuss pertinent education topics. The fostering of a community of professionals among preservice and inservice teachers has continued to be one of the prime outcomes. We have sent out a newsletter to TeacherNet Graduates many who remain in touch online. The rapidly changing technological world gives a new urgency to preparing both preservice and inservice teachers in the use of information available on the Internet.

Students e-mail evaluations of their experiences.

Some comments from students summarizing their experience with TeacherNet:

> *"TeacherNet was extremely beneficial to me because I got the opportunity to learn a great deal about computers. Not only did I learn the many options of word processing but also all of the exciting functions a computer can do. I love electronic mail. It was a great way of relieving stress. I enjoyed writing as well as reading everyone's thoughts about how their day went. TeacherNet also helped me know about upcoming job fairs and conventions."*
>
> *"This semester I've finally moved into the twentieth century! My eyes have been opened to the real potential of computers in education."*
>
> *"TeacherNet was important to me because it gave me the opportunity to vent my frustrations quietly to my peers without anyone else hearing them. I could be by myself and type to my hearts content. The main benefit was being able to read about other's feelings and never feel alone with my feelings."*
>
> *"The computer network is an AMAZING tool that I wish all student teachers could utilize during student teaching!"*

The Future of Telecommunications Networks in Schools

Current government interest in the National Information Infrastructure Act which passed, and the Technology for Education Act which also passed as a part of Goals 2000 highlight the importance of training educators to become leaders in developing a coordinated national network and producing models for integrated technology use in the classroom. These technology innovations, however are in danger of Republican cutbacks and very much at risk. It is vital that educators write to their congressman about these important funding issues for technology, without them our schools will never be able to provide what our children need to become workers in an information society.

The connected classroom has access to global information. Study of government can include direct communication to the Senate e-mail. Students will be able to follow the working of the democratic process as never before possible. Senator Kennedy's office has pioneered online access and posting of important bills. There are now 76 Senators with homepages and almost 200 Representatives. This is a valuable resource for our students to follow their legislator's activities in congress (Casey, 1993). According to Chris Casey, Technology Advisor to the Senate Democratic Technology and Communication Committee, 30 million people have access to the Internet with a million more finding their way each month. They are getting information, sharing thoughts and ideas, learning and developing communities online. A guide to Congress online called CAPWEB that Chris Casey and Jeff Hecker authored can be found by teachers and students at http://www.capweb.com. Our student teachers and their elementary and secondary school students must be a part of these growing communities.

The graduates of TeacherNet, Teacher-LINK, BCTN, and other programs like them across the nation are trained and ready to accept this challenge. Organizations like the Association of State Technology Using Teacher Educators (ASTUTE) and the Computer Using Educators (CUE) Higher Education Group are ready to take on the task of expanding this program statewide. Organizations like the National Education Computing Association (NECA) are focusing on Technology Implementation and Educational Reform in their upcoming NECC '97 Conference. Appropriate funding must be made available at the Federal and State levels for these changes in teacher training to occur. The use of the computer by the student teacher in their home for a semester in connection with their training is a far better way to train teachers to integrate computers in their classrooms then any workshops or once a week computer classes at a distant site could ever be. We, as teacher educators must continue through our leadership to expand and improve our programs and make sure that we play a significant role in the National Policy decisions being made at this time and do our part in preparing new teachers to implement the online classrooms needed in our schools.

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General Session: New Curriculum Designs/Instructional Strategies

Successful Partnerships: The Texas State Aquarium Computer Sea Camp 1996

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Key Words: **partnerships, computer camp, project**

Session Summary

For several years the Texas State Aquarium has offered week-long sea camps for non-resident campers, ages 6 to 14. Campers set up an aquarium, do environmental studies, learn canoeing and water safety, take trips to the Aquarium and even spend the night in order to observe the nocturnal animals. However, computers have never been a part of the camp.

In the spring of 1996 Julie Wallace, then of the Business Alliance of Corpus Christi, Texas met with Karen Ryan, Director of Science Education for the Texas State Aquarium, to discuss how businesses could facilitate a computer sea camp. They agreed to offer one week-long session of computer sea camp.

They recruited others into the partnership in order to ensure the success of the project.

- Jeanette Cates of SchoolVision of Texas agreed to train the teachers and write the curriculum materials for the camp.
- Susan Utter of Corpus Christi ISD agreed to provide the multimedia computers to be used for training and during the camp.
- The Corpus Christi Caller-Times newspaper agreed to house the Web pages that Dr. Cates authored and posted daily.

Response to computer sea camp was overwhelming. It was the first of the sessions to fill its registration. The waiting list was twice as long as the number of participants who could register.

Twenty-four campers participated in computer sea camp. They ranged from age 9 to 12 and came with a variety of computer experience and non-experience. Each group of three campers chose an animal for their project. During the week they learned to use HyperStudio (no one had prior experience), used the QuickTake camera to take pictures of themselves and their animals, used a video camera to capture footage of their animal, researched their animal in books and on the Internet, then combined all of their knowledge into a multimedia presentation on their animal. This was in addition to learning to canoe, visiting the aquarium several times and even having a sleepover! The activities culminated on Friday with student presentations to the group, then an open house for parents and the community.

The Computer Sea Camp was declared a major success. Participants learned quickly in the intense environment. The technology brought additional outlets for their new-found knowledge. Parents and community members were impressed with what the campers could do. And all of the partners felt that their involvement was very rewarding!

This panel will outline the key components of putting the partnerships together and ideas for recruiting and facilitating partnerships. They will discuss the importance of making sure that all partners are rewarded for their participation. In addition, you will see some of the projects that the campers produced.

Dr. Cates is publishing a book based on the project. The book contains all of the curriculum materials in both a Macintosh and Windows format, as well as an outline for planning a camp, enlisting partners, dealing with camp logistics, marketing the camp, training staff, operating the camp, and evaluating your success.

TEXAS STATE AQUARIUM
SEACAMP

Scheduled Activities

Monday
- Introduction to computer
- Create Intro stack in HyperStudio
- Take and add QuickTake picture

Tuesday
- Create Project stack
- Add sound to your stack
- Research print-based and CD materials
- Draw your animal

Wednesday
- Create video of your animal
- Take pictures of you and your animal
- Take picture of your animal
- Use Internet for researching your animal

Thursday
- Work on your HyperStudio stack
- If your animal is nocturnal, take pictures and video

Friday
- Complete your work
- Compare it to the project checklist
- Present your projects to the group
- Prepare for Open House

TEXAS STATE AQUARIUM
SEACAMP

Sample Partial
Schedule
Computer Camp July 8–12, 1996

Tuesday	**Groups** **A & B**	**Groups** **C & D**		
9:00	canoe	sharks		
9:30	canoe	research		
10:00	sharks	canoe		
10:30	research	canoe		
11:00	aquarium set up			
11:30	lunch	lunch		
12:00	computer	computer		
3:00	dismiss	dismiss		
Wednesday	**Group A**	**Group B**	**Group C**	**Group D**
9:00	shark touch	shark touch	shark touch	shark touch
9:30	Internet	photos	video	library
10:30	photos	video	library	Internet
11:30	lunch	lunch	lunch	lunch
12:00	shuttle	shuttle	shuttle	shuttle
12:30	computer	computer	computer	computer
3:00	dismiss	dismiss	dismiss	dismiss

General Session: Technology Implementation/Educational Reform

Technology as a Tool for Engaging Learning

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Key Words: **technology learning tools, math, cooperative learning, engaged learning, team teaching**

Technology as a Tool for Engaging Learning

It is March. My Algebra I students and I have been together for seven months. Looking back on the goals I set at the beginning of the year, I feel we have learned much. I wanted my students to successfully learn important Algebra content, and they have done so. Another goal has been for students to become engaged learners. I have encouraged students to become effective communicators, value differences among their peers, learn from each other's strengths, and support one another in their work.

By now students have already engaged in various cooperative learning approaches such as, "Numbered Heads Together," "Think-Pair-Share," and "Partners." But I feel it is time for us to put the pieces together. I want students to take responsibility for their own learning, and more fully appreciate the importance of group learning processes.

Toward this end, I have decided to implement a math project in which students will be expected to assume responsibility for learning, and work collaboratively. It is my hope that this will provide them with insights into the kind of group work that is becoming increasingly common in our modern society.

Fortunately I will not be alone. The district Director of Curriculum has provided me with a tool for reflecting on engaged learning. This tool enables me to analyze and integrate the various teaching and learning strategies I have implemented. Furthermore, the Library Media Center (LMC) Director, and the Educational Technology Coordinator will help students with the use of the school library and technology resources.

Building on current educational research, I developed a plan for the project.

I. Learning Strategies to be Integrated

A. Concrete examples of integration of the National Council of Teachers of Mathematics (NCTM) Standards in student learning experiences.

1. Demonstrate understanding of math topic
2. Communicate the concept clearly
3. Demonstrate skills as a problem solver
4. Demonstrate application to real world
5. Demonstrate confidence in their ability to do math

B. Cooperative learning group skills
C. Research skills through LMC resources
D. Presentation skills
E. Technology as a learning tool

II. Other Components to be Integrated

A. Assistance of LMC Director, and Technology Coordinator
B. Authentic assessment
  1. Peer evaluations
  2. Community evaluations
  3. Staff evaluations
  4. Administrator evaluations

III. Implementation

A. Selection of Topics—The teacher selected the following topics to be researched by the groups:
  1. Polynomials
  2. Factorization
  3. Systems of Equations
B. Introduction of Group Project Expectations
  1. Students are to work in groups of 2 or 3
  2. Students will select group members
  3. Each group will select a topic to research and present to peers and community members
C. Stages of Project Development
  1. Research topic through the use of LMC resources and the World Wide Web
  2. Develop an outline/description of presentation that includes:
    a. History, e.g. mathematicians who have studied the topic
    b. Explanation of math concept with visuals and/or hands-on activities
    c. An example of real life application
  3. Putting the presentation together
  4. Presentation and Evaluation
D. Documentation and Evaluation
  1. Samples of student work
  2. Video tape
  3. Assessment tools

Assessment tools were given to students at the beginning of project to provide them with a clear understanding of the expectations

IV. Wrap-up Discussion

A. Accountability of students that were absent for group presentation
B. Valuable characteristics of group members identified by students

V. Concerns

- A. Task too difficult for students
- B. Too time consuming for students and teacher
- C. Discipline problems due to nature of project
- D. Not being able to cover the whole curriculum by end of school year
- E. Finding evaluators from community

VI. Findings

- A. Plenty of time to cover the curriculum
- B. Students had more time to prepare for final exams
- C. Increased math communication
- D. Increased technology skills
- E. Willingness and enthusiasm of students to utilize technology to do project
- F. Project took longer than expected to prepare
- G. Community members participated willingly
- H. Different evaluation comments/expectations of students, school staff, and community members

Students + Technology = Engaged Learning

Valuable Characteristics of Group Members Identified by Students

Valuable Characteristics Identified by Second Hour Algebra I Class

1. Ability to stay on task
2. Sharing work load*
3. Positive attitude towards group and task
4. Leadership in organizing*
5. Cooperative/willing to do work
6. Creative

Note: Class negotiated that those students that were absent for their presentation must do presentations by themselves and be evaluated by the teacher.

Valuable Characteristics Identified by Third Hour Algebra I Class

1. Doing good research
2. Cooperative/willing to do work*
3. Participation/determination
4. Work hard to meet deadlines*
5. Care about good grade
6. Good personality/willing/have a sense of humor
7. Extraordinary typing skills
8. Creative
9. Ability to synthesize information

*Class agreed that these characteristics were the most valuable characteristics in group members.

General Session: New Curriculum Designs/Instructional Strategies

Math, Multimedia, and High Stakes Tests

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Key Words: **math, multimedia, test, business, partnerships, Texas, TAAS**

This session demonstrates the classroom development of an interactive computer program designed to help students who were unable to pass the Texas Assessment of Academic Skills, TAAS, test. Mastery of the "TAAS" is a Texas Education Agency requirement for graduation from high school. It covers mathematics content through 8th grade.

The project began with a grant providing Clark High School in San Antonio, Texas, with computer equipment and software. The purpose of this grant was to use technology as a vehicle for thematic interdisciplinary learning activities. The project chosen to achieve this goal was "San Antonio." This project will be demonstrated in the session. Computer science and calculus students were working side by side with art and music students learning multimedia design. Teachers met frequently to coordinate activities. Software packages used were: Authorware Professional for Windows, CorelDraw, Animator Pro, Finale, and others.

One of the most exciting aspects of the project was the involvement of business partners in the development. A large San Antonio production house, Matchframe, took a special interest in the project and students, allowing the students to use the film editing equipment and other company resources. Students were able to participate in the production of large commercials for accounts such as "Coca Cola," "Taco Cabana," and more. The high school students were invited to help in the graphics and animation creations included in these commercials. Many students continued to work for the company as employees after graduation.

The most useful product of this venture was the "TAAS Mathematics Review" which is used in Northside Independent School District and other districts in Texas to help students understand mathematics. The TAAS program was requested by students desperate to graduate. The students continue to update the program and critique its effectiveness.

This project showed the teachers at Clark High School that learning can be fun, useful, exciting and profitable. Business relationships can be not just a charity situation but ideally a partnership beneficial to both business and education.

General Session: Technology Implementation/Educational Reform

Building Network Infrastructure

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Key Words: **network, infrastructure, wiring, bridging networks**

Presentation Summary

It is our intention to share with participants our experiences networking our building. We will describe how we successfully bridged a LocalTalk network with an Ethernet network so that we could provide connectivity between older computers (Mac Classic, SE, SI), newer faster running Power Macintoshes, and computers running the IBM platform.

We will point out the pitfalls that have delayed us in the realization of our technology vision. Our focus will be on a do-it-yourself network that many technology oriented teachers are discovering is the only way to get the job done.

We will provide the names of suppliers for wire (along with types needed 10BaseT, 24 Gauge), crimping tools and end connectors. We will demonstrate stripping and crimping of wire, connecting of RJ-11 and RJ-45 connectors and connecting mini-punch-down connectors.

Our intention is to discuss how we currently use the network and how we expect to begin to use it in the future. It is our hope that we can begin to point people in the right direction and avoid the pit-falls that we have fallen into due to lack of experience.

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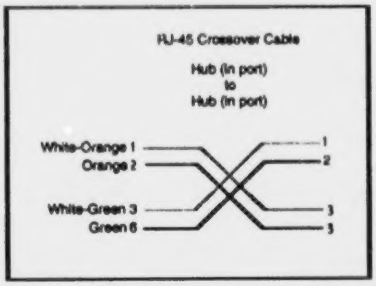
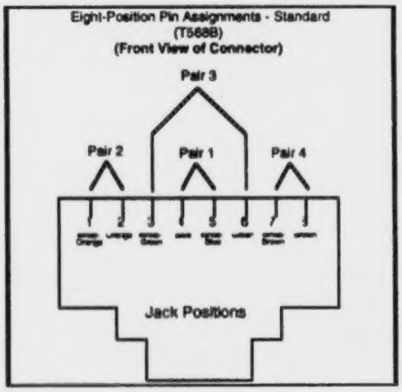
Eight Position (RJ-45) Modular Cable

PIN	SYMBOL	FUNCTION	SIGNAL TYPE	PAIR	WIRE COLOR	CONNECTOR MODULE (in classroom)
1	TD+	Transmit Data Plus	Output	2	White-Orange	Gray
2	TD-	Transmit Data Minus	Output	2	Orange	Orange
3	RX+	Receive Data Plus	Input	3	White-Green	Black
4	Not Assigned			1	Blue-White	Red
5	Not Assigned			1	White-Blue	Green
6	RX-	Receive Data Minus	Input	3	Green	Yellow
7	Not Assigned			4	White-Brown	Blue
8	Not Assigned			4	Brown	Brown


RJ-45 Crossover Cable
Hub (in port)
to
Hub (in port)
White-Orange 1
Orange 2
White-Green 3
Green 6
1
2
3
3


Eight-Position Pin Assignments - Standard
(T568B)
(Front View of Connector)
Pair 3
Pair 2
Pair 1
Pair 4
1
2
3
4
5
6
7
8
Jack Positions

BEST COPY AVAILABLE

General Session: New Curriculum Designs/Instructional Strategies and Workshop

CD-ROM Recording: It Will Work in Your Curriculum

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Key Words: **multimedia, CD-ROM, director, authoring, history**

After 16 years of teaching Middle School Arts/Crafts and U.S. History, I made a dramatic change in my curriculum and the way I taught. I went from a classroom with absolutely no technology, to one that is completely based on technology. I made the first change in my art class. I began to write grants and receive powerful Macintosh computers and sophisticated graphic software. The students' response to this infusion of technology into the classroom was very positive.

After a year of exploring the potential of all this new found hardware and software, I began to see the possibility of implementing this technology into my 8th grade U.S. History class. I would take my history students to my graphic lab and we would break into groups and create simple, very short history videos in the computer. I had been looking for great history project ideas for my students to do to break the boredom of learning by rote, and this seemed to be the answer. It not only involved the students in the history curriculum, it brought them into contact with the most sophisticated hardware and software on the market.

My next step was to choose authoring software. I chose Macromedia Director because it is the most widely used multimedia program in the world (80% of all CDs are created in Director) and is extremely powerful. Once I learned to bring together text, pictures, art, animation, sound, and video, I then had to come up with a method of totally immersing this powerful tool into the history curriculum. False starts and mistakes eventually led to the program I now use in a very successful way.

The first day of school I let the students create their own groups of four. The groups consists of an art director, copy director, research director, and a project director. The project director is responsible for meeting with the teacher to discuss all details, picking up new unit folders, handing in unit folders for grading, and building the project in the computer. The art director is responsible for pictures, art work, animation, and the overall aesthetics of the project. The copy director is responsible for all text and editing. The research director is responsible for finding sources of information and dividing up the reports that must be written so it is equally shared. This allows the students to contribute to the project in a style in which they feel comfortable and proficient. This will encourage students of all learning styles to become engaged participants. They will remain in these groups the entire year. They must learn to work together and I let them solve their own disputes by themselves. I only get involved if there is a real problem and they are never allowed to switch groups.

I have created what I call an engine. This is an outline of the material we will study for the entire year. This outline follows the text book and is linked in a manner that adapts itself to multimedia (see example). I introduce these units to the students one by one throughout the school year. They work in their groups creating videos, sound, text, art, and scanning pictures, to create an articulate, informative, interactive presentation about a period in our history. As the year progresses, the number of units completed grows, and the students link their project together into one large finished presentation that is then pressed to CD. Each student will leave my history class with a CD-ROM that his/her group created. Each unit is graded as it is completed and the students are graded on an individual contribution basis. I look at what each student was responsible for within his/her group, and I assess them for the quality of that work.

The fact that this project will be made into a CD-ROM is highly motivating to the students and the project takes on a life of its own. The students continually refer to it as "The Project." The theory is, if you set this up properly, the students will eagerly engage the curriculum, move mountains for you, and learn without even knowing they are learning. Project based, curriculum driven learning must be supplemented with lectures and discussions to bring it all together for the student, and the teacher must clarify confusing issues. The students are given material they must know and understand. They are periodically tested on this information to check for understanding.

I believe this is a very exciting, successful way to implement technology into the curriculum. We must continually keep our focus on the curriculum and strive to keep the technology transparent. The technology must always remain just another tool. The rewards of this program are numerous. Students are learning how to learn on their own, and what they learn on their own, they appear to retain. Learning truly becomes meaningful. They are also learning to work as a team to coordinate a complex project. We still use textbooks and the students still have to read and memorize, but by shifting the emphasis from learning by rote to learning by doing, I believe they are developing skills that will be far more valuable to them throughout their lives. I believe the way I used to teach, gave the students many ways to fail. I believe the way I teach now, gives them many ways to succeed.

List of Hardware

Work Station 1
  Macintosh Quadra 800 3,000 MB HD 16 MB RAM CD-ROM Radius
  Video Vision Studio Capture Board

Work Station 2
  Macintosh Quadra 800 1,000 MB HD 16 MB RAM CD-ROM Digital Video Capture Board

Work Station 3
  Macintosh 6100/60 AV PowerPC 16 MB RAM CD-ROM Apple Video Capture Board

Work Station 4
  Macintosh 5200/75 AV PowerPC 16 MB RAM CD-ROM Apple Video Capture Board

Work Station 5
  Macintosh 5300/100 AV PowerPC 16 MB RAM CD-ROM Apple Video Capture Board

Work Station 6
  Macintosh 5300/100 AV PowerPC 16 MB RAM CD-ROM Apple Video Capture Board

Scanning Station

Macintosh IIci, Hewlett Packard ScanJet IIc

8 Macintosh LCII Computers

Canon Still Video Camera RC-250

Canon UCS5 HI-8 Video Camera

Kodak PCD 225 CD-ROM Writer

Iomega 1 gig Jaz Drive

6 NTS Dream Writers

List of Software

Adobe—PhotoShop 2.5, Illustrator 5.0, Premiere 4.0
Aldus—Freehand 3.2, PageMaker 4.0
Macromedia—Director 4.0, Sound-edit-16
Gryphon—Morph

Magazines

MacWorld
New Media

General Session: Technology Implementation/Educational Reform

Using Technology and Systemic Thinking to Create or Enhance Learning Organizations

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Key Words: **using technology, systemic thinking, learning organizations, educational reform, description**

Using technology to formulate an integrated K–12 curriculum is a perfect vehicle for transforming the normally hierarchical school or school district environment into a learning organization. Systems thinking is needed to create the integrated K–12 technological curriculum and requires that the Superintendent, principals, technology coordinators, curriculum coordinators, teachers, students, parents, and the school district community articulate individual visions and ultimately share the same vision.

For almost 15 years, schools and school districts have been attempting various ways to reform the system. Most of those reforms have not lasted, nor has any real change occurred. In those schools or school districts where technology has been used as the vehicle to form a learning community, the change has lasted.

The presenters will share their experiences and show a multimedia presentation with examples of schools or districts that have become learning communities with integrated technological classrooms at various grade levels and in various disciplines. Comments from Superintendents, principals, technology coordinators, curriculum coordinators, teachers, students, parents, and the school district community in this type of environment will be included. Successful professional development ideas will also be shared.

The Community Discovered: Creating a Community of Learners for Tomorrow's World

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Key Words: **education reform, arts integration, technology innovation, constructivist education, Challenge Grants**

The *Community Discovered: The Search for Meaning Through the Integration of Art and Technology in K–12 Education* is one of 19 Technology Integration Challenge Grants awarded by the U.S. Department of Education in 1995. The purpose of this project, consistent with the Challenge Grant Program, is to institute educational reform practices through integration of technology. Specifically, The Community Discovered is designed to transform education by promoting constructivist curricula through the integration of art and technology in the pedagogical environment of K–12 classrooms. A special emphasis has been placed on serving disadvantaged students in rural and urban areas. The focus of this project is to develop curriculum models of engaged student learning using technology and resources of the Internet to link the visual and performing arts with other subject areas.

This multi-element education program brings the arts and art museums into classrooms electronically; develops computer integration strategies; trains and supports teachers; builds curriculum, instruction, and assessment strategies; and seeks to build a nationwide community for the arts and technology integration. Underlying these elements is the conceptual foundation for the project, based on Vygotskian theory and analysis of instruction: that learning environments are social systems that are mutually created by children and adults (students and teachers), in which children learn by engaging in collaborative activity. This interdependence of adult and child is central to what is referred to as constructivism. It is not typified by rote practices in which students passively sit in silence, follow directions, read assigned texts, and work in isolation to complete work sheets and tests. Rather, it is an environment in which children create new knowledge and form new cognitive constructs through interaction with others in problem-solving activities that link their 'everyday' understanding of the world with the more formal or 'scientific' schooled concepts. Teaching and learning become a generative process for all participants.

As noted by Moll (1990), Vygotskian theory purports that "everyday concepts provide the "living knowledge" for the development of scientific concepts. That is, everyday concepts mediate the acquisition of scientific concepts… that everyday concepts also become dependent on, are mediated and transformed by the scientific concepts; they become the "gate" through which conscious awareness and control enter the domain of everyday concepts (Vygotsky, 1987; p.193). Thus, scientific concepts grow down into the everyday, into the domain of personal experience, acquiring meaning and significance, and in so doing "blaze the trail for the development of everyday concepts" upward toward the scientific and facilitate "mastery of the higher characteristics of the everyday concepts" (Vygotsky, 1987; p.219)" (p.10). "To make schooling significant one must go beyond the classroom walls, beyond empty verbalisms; school knowledge grows into the analysis of the everyday... children's perception and use of everyday concepts is transformed by interacting with schooled concepts; everyday concepts now form part of a system of knowledge, acquiring conscious awareness and control" (Moll; p.10).

Vygotsky observed that the collaborative activity or social interactions in which teaching and learning occur are mediated through use of cultural signs and tools, such as speech, literacy, and mathematics. Children learn these signs and tools by interacting with more experienced users of these symbols—adults from their culture. At the same time, it is through interaction with these symbols that children generate their own knowledge or understanding of how to use these signs and tools to mediate interactions with others; to communicate their personal intellectual activity. Thus, while these artifacts are social in origin; they are used to mediate contact with others—to communicate; as the use of these artifacts becomes internalized, these same tools are later used to mediate one's own thinking.

Parallel to the Vygotskian notion of cognitive development and the use of cultural symbols for mediation/communication, is the generative nature of the arts as an expression of the artist's thinking and a form of communication with an external audience. The artist develops their tools or symbols by linking their 'everyday' knowledge and experiences with the 'schooled concepts' of their art form by interacting with the more mature users of these tools. That is, the artist expresses their own thoughts through the tools of painting, photography, dance, music, and other art forms. The artifact of their work is not a static product, but one that was shaped through the generative process of linking the artist's personal experiences and perceptions of life events to their understanding of complex systems. Through use of the tools of their art form, and through interaction with more skilled artists, an individual artist represents their own thinking by manipulating the tools and symbols in a unique and dynamic manner to create a personal expression. Thus, any individual work of art is not to be passively viewed, but examined from various perspectives related to the medium by which it was created, the historical events that shaped the content and manner of presentation, the context in which it was and is expressed, and the perceptions of the audience(s) who experience the work. In this way, each individual interacting with any particular art work will have the opportunity to explore, in-depth, the social, historical, aesthetic, and scientific aspects of that work and the artist creator. In this way, the arts become the infrastructure, form the backbone, for creating links to traditional school curricula such as science, math, history and language arts. Further, through the individual's experience with and perceptions of particular art works, each person forms their own connections between their personal/everyday understanding of the world and the scientific concepts presented in schools.

In addition to forming a logical infrastructure for generating knowledge of core curricular concepts and basic skills, the use of the arts facilitates interaction with a set of symbols that represent cultural artifacts equally as significant as those more traditional symbols of language and mathematics. As the learner interacts with these symbols, they too become more competent communicators, using these symbols to represent their own intellectual activity and to internalize these symbols for use in the construction of new cognition; to use the artifacts for thinking and problem-solving. Through creation of their own art works, the individual develops another form of expression to use in the social exchange process and at the same time becomes a more competent user of the symbols. Thus, consistent with the Vygotskian theory of learning as it relates to other symbols or tools more commonly associated with education (language, speech, mathematics) it is through interaction with the symbols of the arts that children generate their own knowledge or understanding of how to use these signs and tools to mediate interactions with others—to communicate their personal intellectual activity.

For more information or copies of handouts see http://communitydisc.wst.esu3.k12.ne.us

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General Session: Technology Implementation/Educational Reform

While You Were Sleeping, Your Paradigm Shifted: Leadership, Change, and Technology; Or ... How to Change a Tire on a Moving Car While in the Fast Lane

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Key Words: **change, leadership, technology, public education, stress**

Presentation Summary

A lively, sometimes humorous, assuredly provocative and dynamic presentation dealing with the concept, attributes, and importance of leadership in a technological era which is generating change at an increasingly compounded rate beyond our capacity to absorb. This rapid, profound change, which affects every aspect of our personal and professional lives, creates constant, often unrealized stress. What are the change forces—the economic, sociological, technological trends—which will shape a different 21st century world? What will that world "look like?" What type of visionary leadership is needed? What strategies can help cope with change, its stressful byproducts, and its complexities?

Presenter discusses the relationship of leadership, technology, and change, integrating these concepts into a formula for successfully empowering an organization to deal with them in positive, productive terms. The specific stages and characteristics of change, resistance to change and how to lead others to embrace it, the qualities of dynamic, effective leadership, and a new formula for leadership is presented. Current and future trends in society, the family, culture, world economies, governments, and especially emerging technologies, are focused on. What is happening to the traditional family unit, how is immigration changing our nation's sociological landscape, what effect do the emerging third world countries have on the global economy and on our current position as the world power?

Most importantly, the presenter focuses on public education, and how technology will drastically change traditional concepts of teaching and learning. With a mission statement of, "information everywhere, communication anytime, access to everyone," the presenter shatters past and current teaching and learning institutions and styles as anachronistic, irrelevant, and inadequate for preparing children to be 21st century knowledge workers within a global economy. The NET is discussed as a primary change force in present and future learning. The profound implications and potential of telecommunications are juxtaposed against the traditional notion of school. The new 3R's are restructure, retool, and reengineer.

Traditional Poster Session

Technology Applications on a Silver Platter

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Key Words: **technology, virtual museums, World Wide Web, learning styles**

Are you still wondering how to approach technology with your students? What methods and models are being utilized by other educators in integrating technology into the curriculum? In schools today, teachers and administrators feel pressured to use technology. Many of them, knowing the time limits for covering the curriculum, fear that adding technology means subtracting important time on other subjects. This session will focus on project-based learning where students learn to gather, assemble and analyze information to create *virtual museums* (a collection of digitized artifacts) which will be publicized on the *World Wide Web. Learning styles* and the changing role of the teacher and learner will be addressed during this session. *Internet* applications for classroom implementation will also be discussed.

Participants will view examples of *HyperStudio* stacks utilizing a variety of technology tools, i.e., digital cameras, scanners, *CD-ROMs*, Internet. Handouts will provide Web sites for a variety of subject areas K–12 and ideas on technology applications.

Workshop

Staff Development and Technology: Rethinking the Training Paradigm

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Key Words: **staff development, Internet, change theory**

The infusion of computer and related technologies in the classroom requires that many teachers change the way they teach. Taking advantage of the power of technology allows classrooms to be structured in such a way that the teacher can truly be a guide for students rather than the sole source of information.

To take advantage of the power of technology and employ new classroom teaching strategies, teachers need access to technology, time to learn, time to practice, and ongoing support. The same technologies used in the classroom can be employed to help teachers learn.

Traditional segmentation of teachers for training is to categorize in groups by grade level or subject taught. A better way is to categorize teachers much as we do students based on readiness to learn. According to the model described in *Tools for Change: Restructuring Technology in Our Schools,* teachers usually fall in one of four groups based on readiness to learn:

- pacesetters—5% of teachers
- empowerables—35% of teachers
- followers—55% of teachers
- refuseniks—5%

The pacesetters, also known as self-starters or early adopters are the ones who often become the technology "gurus." They manage to find resources when others cannot and are always searching for more. This group as a whole are easily bored and impatient with the status quo.

The empowerables are interested in trying new ideas and technologies and are motivated to learn them on their own. Given the resources they need and the time to make connections on their own, they will be highly successful and creative. This group benefits from "just in time" training and attending conferences.

The followers as a group are not yet convinced that technology is here to stay. They tend to be reluctant (i.e., too busy) to participate in training and are intimidated in a large group. However, given the right type of training they will successfully employ technology. Small group training with step-by-step or "recipe" instructions and mentoring opportunities are appropriate for this group.

The refuseniks are those people who hope to retire before they have to deal with technology. They are skeptical that technology can ever work for them and threatened by others who employ the tools. They will go out of their way to avoid all opportunities to learn about technology. This group is small but will require a great deal of effort to bring on board.

Each of these groups requires a different type of training. A school can take advantage of the readiness level of teachers and employ members of the groups to support each other. Teachers teaching teachers has proven to be a very successful model. The small pacesetters group can assist the larger empowerables group. The empowerables can then train the large followers group. The followers group will bring the use of technology into the mainstream of the school, which will pressure the refuseniks into learning the technology to keep their jobs.

Staff development delivered online through the Internet provides opportunities for the pacesetter and empowerable groups to acquire skills on their own. Ideas and step-by-step tutorials for teachers who fit in the followers group and lists of project ideas for teachers who want to participate in online classroom projects can be through the TIES InforMNs Web site (http://informns.k12.mn.us).

General Session: Improved Productivity/Administration

Technological Power Tools for School Leaders

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Key Words: leadership, administration, software, hardware, organizing, time, fun

Where Are We Going...

1. Reality check...
2. Why bother with this "stuff"?
3. Some general thoughts & ideas
4. Getting organized
5. Time management software & uses
6. Contact management software & uses
7. Accounting software & uses
8. The Internet and administrators
9. E-mail software & uses
10. Miscellaneous ideas

Reality check...

- congratulations on your appointment
- the admin. part of your role
- the educational leader part of your role
- the reality of doing more with less
- there are ways to relieve some of the stress....

Why bother?

- why not?
- many routine and mundane tasks can be done in a more efficient manner
- efficiency *should* lead to less stress and more time for other, more important aspects of your job
- you get to have cool toys on your desk....

General thoughts and ideas

- using technology in administration is *not* for everyone
- there is no "right way" to do this
- you will customize and modify your approaches to what works best for you
- beware of "the latest greatest"—let someone else be the guinea pig!
- the learning curve—like eating an elephant

Getting organized

- "a place for everything..."
- I'm somewhat of a fanatic...
- once again, whatever works best for you (and makes sense to your secretary/spouse/children)
- folders
    - ultimate electronic flexibility
    - cascading/hierarchical
    - beware of duplicates!
- organize your computer as you would your desk/office—logical for you
- avoid the "accountant's nightmare" approach to filing
- first step—learn how to create and move folders
- Now Menus (a part of Now Utilities)
    - "the missing part of the Apple"
    - demo time
- yearly "weeding" and archiving
- avoid clutter
- "house clean" and organize regularly

Time management software

- advantages
    - flexible (moving, rescheduling, repeating, etc.)
    - graphical
    - many views possible on desktop
    - lists/categories/printouts/etc.
    - link to contact management software
- disadvantages
    - electronic (print it out or carry computer)
    - others booking appointments
- examples
    - Now Up-to-Date
    - DateBook
    - Claris Organizer
    - others available

Contact management software

- advantages
    - flexible (making changes, etc.)
    - lists
    - address labels
    - link to time management software
    - searching

- disadvantages
  - electronic (print it out or carry computer)
  - others searching addresses (i.e.: spouse, etc.)
- examples
- Now Contact
- TouchBase
- Claris Organizer
- others available

Contact management software (contd.)

- CAT IV
- advantages
  - the mother of all contact managers
  - three dimensional data base
  - accounts
  - contacts
  - letters, etc.
  - create templates and work within your data file
  - account/contact history
  - archiving feature
- disadvantages
  - learning curve
  - manual
  - technical support
  - make a decision carefully to use (or not use) this package
- other "CATish" packages from Chang Labs

Accounting software

- uses at school
  - tracking budgets
  - school bank account
  - parent council account
- flexibility
- ease of use
- report capabilities
- once again, whatever works best for you…
- examples
  - Quicken (basic)
  - M.Y.O.B. (intermediate)
  - others available

Simply Accounting (intermediate)

The Internet for administrators

- a must for all school leaders
- pay for it if you must!
- "walk the walk and talk the talk"
- get a modem and a phone line into your office (use the fax line...)
- dynamic media
    - issues (government, press, etc.)
    - software updates

etc., etc., etc.

- E-mail software
    - quick, regular and "free" communication
    - easier than the fax (transmitting text, not paper)
    - uses
    - letters
    - notes (mini-letters!)
    - exchange files (i.e.: admin. mtg. agenda)
- examples
    - Eudora "Light"
    - Claris E-Mailer
    - others available
    - Eudora "Pro"

Miscellaneous ideas

- paper copies are "safe"
- regular backups
- stationery files
    - for routine, repetitive tasks
    - create and then modify as required
    - examples
    - field trip confirmations
    - petty cash accounts
    - letters to parents

Some closing thoughts...

- this is *not* for everyone
- there is no "right" way
- use what works for you
- lead by example

have fun—enjoy the toys...

General Session: New Organizational Structures

The Curriculum Commons: Teacher Collaboration for Student Learning—Millburn Township Public Schools

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Key Words: **teacher collaboration**

If the curriculum is to be a call to action, naming what we want students to know and be able to do, then the teachers who will be there, in the classroom, must invent it. Invention is a strong word, imbuing the inventor with courage, as well as wisdom, but most of all, with a willingness to try and fail. Curriculum can provide the signposts for these travelers, who will guide students in the way they themselves have come. In the final analysis, success arises from the experiences these guides provide for students to help them make sense of the best of what we know, and to see beyond it to what they need to know.

State and National efforts to define curriculum have provided an excellent set of resources for educators to dip into as teachers plan for their students. Through this Goals 2000 grant, Millburn Township Public Schools will refine its strategic planning process by forming a local GOALS 2000 committee. The district has already identified the priorities of: 1) developing a collaborative curriculum revision process which informs instruction and meets state goals, and; 2) revising the science and math curriculum.

The purpose of this grant is to develop a collaborative curriculum process using information management technology as the linchpin of Local School Improvement. Using an action research model, we will work to build leadership teams of teachers to develop, implement and reflect upon the role of specific curriculum and instruction decisions in achieving outcomes.

Our partners include Rutgers University Center for Mathematics, Science and Computer Education for team-building and research on the process. Preservice teachers will enrich the ongoing research as well as develop as professionals through the reflective process. With our corporate partner, Dr. Mike Berger of Campus America, we will use the IM series to facilitate clarification of goals to meet national and state standards in science, involve teachers in collaboratively creating curriculum on an ongoing basis in a shared workspace. Ongoing discussion and reflection will be captured through the Online Internet Institute, a National Science Foundation funded project.

This collaboration will result in the Curriculum Commons, a dynamic, interactive curriculum, where teachers meet in a virtual space to construct the experiences which will connect students to the best of what there is to know. The Curriculum Commons will contain state and local goals and the essential questions which call forth the enduring ideas in each discipline. As the leadership teams develop benchmarks and assessment tasks, these will become available through the Commons. As teachers shape the experiences which will engage students to think about these questions, their ideas will be captured in the Commons. As students respond to the questions and show what they know, their work will become available in the Commons. For teachers this is a workspace, for students, an archive and for the community, a window into the curriculum.

The Science department will begin the process which will eventually permeate the thinking and doing of the professional educators in the entire district. A leadership team will use the technological tools for identifying the goals, themes, essential questions and assessment tasks in science. Teacher teams will add instructional units, activities, resources and student work. A district team will facilitate use of the tools for thinking about the results and communicating with parents. University faculty and consultants will support the thoughtful development of the materials and support refinement. Preservice teachers will contribute resources and reflection in discussions. Communication about the process from all quarters will be spurred and captured in the archives of the Online Internet Institute.

Other disciplines will follow in waves, learning from the experience of the science department, the math groups will revise the curricula by completing an assessments in line with Core Curriculum Standards. The Local Improvement Plan created through this grant will support the development of competency in students at the benchmark years of 4, 8 and 12 in science (goals 3 & 5) using a process of intense professional development (goal 4) and common assessment tasks. This process will reduce the gap between theory and practice by letting teachers learn by doing and grow by reflecting on what they see students knowing and doing.

How can a vision of professional inquiry result in education improvement?

Education improvement is tricky business. Schools are frequently accused of making successive superficial changes while remaining essentially the same. Like most criticisms, this one is not without an element of truth. When change is by committee rather than through total involvement, added onto rather than essential to the life of the classroom, and based on external goals rather than local concerns, the best intentions do not translate into different learning experiences and outcomes for students. Fundamental change has to occur in the daily lives of teachers and students—in the way they interact, the questions they ask and the way they set and achieve goals together. The problem with most reform is that it does not focus on the daily lives of the teachers and students they work with.

The goal of this grant is to change how teachers do their work and relate to each other to offer the most powerful learning experiences they can to their students. Teachers are professionals and when the system supports professional behaviors of informed action and collaborative reflection, they will respond. We have confidence in this model of a Curriculum Commons, in large part because of the power of technology to provide an ongoing collaborative workspace where teachers can create, reflect and learn together.

Deep reform is based on focusing the energy of everyone on what they do each day to reach specific goals. When they work at this together, they can become a team, create changes in their own ways, and build collective wisdom about what it means to learn. We propose to use essential questions as the critical bridge between the written curriculum and student results. How well can students address questions like, "How do the patterns in nature reveal structure, function and relationships?" and "How do estimation strategies change the outcomes in problem solving?"

How do essential questions and collaboration change how we teach? Perhaps we can address this question by looking at a typical teacher's life in the classroom. The day begins with getting equipment ready for a lab, duplicating materials, or scheduling a video. Teachers connect students to the curriculum through experiences and "stuff." Outside of their contact time with students, they are collecting materials, adapting or inventing activities and then grading the results of the activities. Support comes in the form of texts, teachers own resource files and professional magazines, course work and workshops. Once students hit the door, the activities become a reality. Now is the time when the teacher orchestrates the score she has written and coaches the students to learn through the experience. The results are collected and graded and the next topic or unit is tackled with more resources and activities. Because the majority of a teacher's day is made up of activities he or she has planned, this is the primary focus. Workshops and reading need to be practical—"something I can use tomorrow" because of the pressure of planning so many learning activities for students.

The planning process also serves another important function. By thinking through a variety of strategies, the teacher can "punt" if an activity does not go as planned. This kind of rehearsal strategy may be the most important function of planning, because it frees the teacher to be responsive to how students engage the ideas. How can that thoughtfulness about connecting students with the curriculum be systematically leveraged?

Consider how a teacher plans now in Millburn

Suzanne, a fifth grade teacher, works alone, planning with a textbook in hand, resource materials spread out, or collected in a file folder and some ideas for lessons from previous years, a curriculum guide or a book of collected lessons. She thinks through a sequence of lessons, makes sure she has the materials ready, ordered or easily accessible, and then writes a brief lesson plan, mainly for herself. She uses the lesson, makes some adjustments in the next one based on how well students accomplish the objective and then delivers the next lesson in the series she has planned.

Along the way, student work is collected, graded and returned. At the end of the unit, Suzanne makes a few notes about ideas for next year and then repeats the process with the next topic. Now imagine a different scenario in which this teacher is part of a professional inquiry team:

Suzanne, Tomas, Leslie, Reanin, Griff, Donald, Madeline, Fletch, Kathy and McCord all teach fifth grade, but in different buildings in the district. They are each working on the science curriculum and instruction in the Curriculum Commons from their separate rooms around the district.

Now, Suzanne sits down at the computer and pulls up the essential questions for science at the developmental level of her students. Several members of the K–12 science team, university professors, undergraduates and the science supervisor created these questions over the summer to meet local, state and national standards, and now she is working with that framework on a daily basis. The people who worked on it are available online as part of her team.

Suzanne looks over the lessons her colleagues are using to engage students in thinking about the enduring ideas of science and selects several to incorporate into her plan. She adds a few lesson ideas to the database, queries another teacher, Griff, about where to locate the materials for the lesson he posted and spends the rest of her planning time thinking about how to structure the lessons for her particular group of students.

Along the way, Suzanne will post the results of the lessons she uses. She will improve the lessons she wrote, and make suggestions to the authors of other lessons. She will post student work and compare it with the work of the other teachers' students. She will discuss the most effective learning experiences with her colleagues based on the results they achieved with their students. How does professional inquiry help teachers link daily activities with national goals?

Using the Curriculum Commons, Suzanne does not spend any more time than she does now. But she spends her time differently. The increased access to quality ideas, the accountability to peers and the support offered by daily contact with other teachers teaching the same topics affect the quality of Suzanne's work. She spends more of her time thinking about the essential questions of the curriculum and how students grow in addressing them. She spends more of her time creating activities which work for her students, and analyzing the results to improve her teaching.

With this model of collaborative professional inquiry, local, state and national standards reach deeply into the daily lives of teachers. More than a district committee activity, or a summer workshop, this project will permeate the daily life of the classroom and the cycle of collecting, planning, teaching and grading. Only when that occurs is change systemic and able to survive the cycles of funding and changes in administration.

How will the Curriculum Commons support professional development?

Shifting the curriculum to be focused on developmentally intriguing questions is no easy task. The best intentioned efforts of curriculum developers, staff developers and scholars in the various disciplines have not propelled the curriculum very far in this direction. The situation is similar to the classroom where a teacher changes the curriculum to be problem centered, but does not provide the scaffolding for students to construct their own meaning in relationship to the curriculum goals. They need to understand how the requirements have changed from compliance to invention, from comprehension to analysis and from individual to cooperative learning.

Similarly, teachers asked to implement goal-directed curricula cannot use the compliance, comprehension and independent strategies they have used in the past. They do not get the results. The goal-directed curricula requires a re-thinking of the role of curricula which teachers must come to through experience. Teachers who have accepted this challenge report a gradual process of up to five years in which they develop new ways of thinking, teaching and assessing student work.

In "Teachers' Professional Development in a Climate of Educational Reform," Judith Warren Little makes the point that although well tested models of skill development work reasonably well to introduce those aspects of reform that are "technical" or "can be rendered as a repertoire of classroom practices," much of what is needed is not addressed by "skill training, because it is not readily expressed in terms of specific, transferable skills and practices." She continues, "This aspect of reform calls not for training, but for adequate 'opportunity to learn' (and investigate, experiment, consult or evaluate) embedded in the routine organization of teachers' work day and work year. It requires the kinds of structures and cultures, both organizational and occupational, compatible with the image of 'teacher as intellectual' (Giroux's phrase) rather than teacher as technician."

The Curriculum Commons provides the scaffolding for new, continuing and sustained professional development. It is a model of how teachers can engage their own students in working together to set and achieve their goals. It can open the eyes of teachers who do not know that they need to change. It can provide the vehicle for learning from experience. Like most practitioners, teachers learn the most from experience, their own and others.

The Commons provides a window into other teachers' classrooms and builds their confidence in their own ability to grow and contribute. Like the best teams, the diversity of experience, so long kept hidden by the isolation of classrooms and schedules, can emerge to tie the teams together, make them value each other and link them in a shared goal.

What will the project accomplish?

The Curriculum Commons is designed to be a collaborative workspace for teachers to develop goal-directed curricula and track its implementation through archiving lessons and the student work which results. It is a unique and powerful approach because it centers around the daily activity of teachers with their students, linking them to the goals for all students, and providing an explicit partnership with their colleagues.

Good ideas are often implemented in schools from the top down or the outside in. There is little time or incentive for teachers to develop sufficient ownership and the shared vision needed for systemic and sustainable reform. The perception is that such involvement is difficult, would take too much time, and delay implementation. System theory teaches us that positively reinforcing loops can create change if the delays are acknowledged and built into the plan. The "delay" in this system is the reflection and communication teachers need to construct a new vision of what and how they teach and how students learn. It is not a delay, but the catalyst for change.

General Session: Exhibitor Presentation/Current/Emerging Technologies

The Future of Technology in Education

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Key Words: **educational technology, software, technology history**

What is the key to educational technology? The key is software—and what the students and teachers do with it. Judging the appropriateness, effectiveness, and capability of technology in the classroom is difficult. New classroom tools mean new opportunities for learning and teaching. Simple-to-use multimedia authoring applications; digital media collections; the Internet; and new, educationally valid curriculum-based software are all making the technology-centered classroom a reality.

The Quaker saying "Begin small and start promptly" is the best advice for dealing with the rapid-fire change in technology. Just consider the following: Animators who used to spend months and even years hand-painting cels for cartoons are being replaced by computers that can do the work in a tenth the time. The United States Postal Service delivered a record 180 billion pieces of mail last year; however, over *one trillion* e-mail messages were sent. Built in 1946, ENIAC (Electronic Numerical Integrator And Calculator), the first all-electronic computer, had 19,000 vacuum tubes, weighed 30 tons, took up 18,000 square feet of space, and ran only five days without needing repair. Since then, the efficiency of information technology (a $30 scientific calculator has more power than ENIAC) has jumped by 32 orders of magnitude—100 octillion times—the greatest improvement in human history. In 1972 there were only 150,000 computers in the world. By 1999 one company alone expects to ship 100 million computers. Fiber optics now allow us to deliver 1,000 billion bits per second—that's every issue of the *Wall Street Journal* ever printed delivered in one second. Virtual reality is nearly as "real" as reality. Commercial pilots used to fly empty planes for practice; now they train exclusively in simulators. The first time they ever fly their assigned plane it is filled with passengers. There are now 30 million home pages on the Internet, with a new one added every four seconds. Some sites on the Internet are visited over 12 million times a day!

OK, so a lot is happening, we need to act to stay current, and software is the key. How do we know which software is best? To be effective, educational software must have four key attributes: Presentability, Accountability, Customizability, and Extensibility—or collectively, PACE.

Presentability, the first essential attribute, is the software's overall appeal to the user. Black and white, two-dimensional flip screen workbooks cannot possibly compete with the exciting, full-color media students and teachers are exposed to daily. Rich, three-dimensional graphics, enhanced stereo sound, captivating animation and video, and interactive devices that students can control and manipulate are all necessary elements of successful software. However, these elements must not be engaging at the expense of educational validity. After all, the student is trying to learn and the teacher is trying to teach. The software must engage, but it also must reach educational objectives and be based on recognized national standards. Edutainment software sets out to entertain first and educate eventually, which is unacceptable. Teaching software should not be held to a different or more lenient standard than would a textbook or other classroom aid. Software that does not meet the standards of your state, district, or school has no place in the curriculum. Software should also have varied presentation modes, so it can be used the three ways people teach and learn: as a whole-class discussion to introduce ideas and concepts; with several users to support cooperative learning groups; and as individualized instruction, adapting to the needs and levels of each user.

Accountability, the second component of PACE, is absolutely essential. Evaluation of student work and progress is what allows teachers to provide individual assistance and encouragement. Without evaluation and objective accountability, educational software is meaningless. Integrated databases, question templates, and curriculum-based challenges help teachers monitor real progress and provide students with needed feedback on their efforts. Without such accountability, understanding can hardly be verified. Accountability can be integrated into software in several forms: following a traditional testing format, a real-world application challenge, or a student-generated portfolio. Some educational theorists are too anxious to abandon evaluation because of inherent subjectivity, giving up the ability to verify student accomplishment. Verification is an important part of life, and, regardless of views on grading theory, students need to have their work and progress evaluated.

Customizability is the third essential PACE element. Programs should never be "canned." One advantage of computers is adaptability. Technology should be moldable in the hands of the teacher to be individually suited for the student. Only by allowing user customization does the program adapt to students and the curriculum. With easy-to-use teacher controls and preference settings as well as topic editors, lessons can be customized for what is taught, how it is taught, and how students are evaluated and rewarded. Success levels needed to continue, pre- or post-testing on or off, motivators on or off, narration availability, certain lessons enabled or disabled, and timed or untimed testing are just some examples of how every teacher should be able to change the software to meet the needs of a specific classroom.

Extensibility is the final essential PACE component. Extensible software is easy to augment, easy to take beyond its own environment, and supportive of the creation of new things. An example of software easy to augment would be the option for teacher and student projects to be integrated into the program. If a geography program focused on the teaching of map-reading then it should be not merely possible but actually easy to integrate a local map in the lesson. To go beyond that environment, it should be possible to share the local map lesson with students from all over the world, say via the Internet, through a simple conversion process that both students and teachers could use. Finally, extensible software would allow for the creation of a totally new thing, such as a complete interactive project on the local city, with color pictures and video, interviews with local officials, an online guide to major attractions, and more. Students really *do* learn by doing. This project should be easily distributed with a player or via the Internet so it can be shared with others. Software that is not extensible has little value in today's classroom.

Recent surveys of businesses conclude that the traits most desired in new employees are effective communication, ability to work with others, leadership, flexibility and maturity, resourcefulness, inquisitiveness, and the ability to learn. Software with the PACE characteristics supports the development of these very traits.

John Stuart Mill once said, "One person with a belief is equal to a force of 99 who only have interest." When evaluating software and technology for the classroom, be certain you believe in what you are doing—an interest is simply not enough. Then, act promptly.

Using Borland's Delphi in CS 1 and 2

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Key Words: **object-oriented, visual programming, CS 1, CS 2**

Beginning Fall 1996, as part of a redesign of our entire Computer Science curriculum, we have moved from the relative Dark Ages (mainframe Pascal) to the visual and object-oriented environment of Borland's Delphi for use in our CS 1 and 2 courses. In our presentation we will share examples of lab experiences that have worked well, and some that have not. We will also allow time for audience participation by others who have used a visual environment in the first courses, so that we may all learn from each other.

As this summary is being prepared, we are still refining our labs. We have begun the year "armed" with some labs, written by one of our seniors, designed to get the students started using Delphi. During fall semester, we tested these labs on a group of students who are in transition from the old curriculum to the new—they helped in refining these labs for use by students whose entire experience will be in our new curriculum. Some of the labs are focused on implementation of a game that would have been prohibitively complicated to get working within a semester using the old approach. What had been provided by the aforementioned senior turned out to be almost too much in the new approach, but was completed by a few students. The game project therefore is undergoing substantial revision, and we will use only parts of it during the spring semester. In addition to the game labs, we will have some lab experiences in the area of data structures in the new version of CS 2. We have written and will share as handouts and on the NECC CD-ROM four introductory-level Delphi labs, which while being fairly low-level did allow the students to experience some graphics and database programming.

In the redesign, our curriculum has moved from a programming-oriented CS 1 to a breadth-first approach in that course. We expect that despite much less emphasis on programming, the students will find themselves capable of doing much more than those in our previous CS 1, because of the Delphi environment. We are particularly hopeful that the combination of breadth-first material and the friendlier programming environment will enable us to attract and retain more female students, definitely the majority at our university, into the Computer Science program.

Delphi is a trademark of the Borland company.

Internet Poster Session

Implementation of Interactive World Wide Web-Based Science Curricula

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Key Words: **World Wide Web, science curricula, interactive learning**

Live from Earth and Mars (http://www-k12.atmos.washington.edu/k12) is a NASA-funded World Wide Web (WWW)-based science curriculum project. Project staff work collaboratively with local K–12 teachers and school administrators to produce curricular materials and resources which are posted to a public WWW site. The modules feature data and science concepts focused on Northwest weather and Mars exploration including live data from the Pathfinder mission. The project is based at the University of Washington in Seattle and includes local K–12 teachers, atmospheric and planetary scientists, engineers and computer professionals as collaborators.

The WWW is an engaging and convenient way to present information, movies, sound, hypertext, and to wander around the Internet. It is also enjoying an unprecedented rate of explosive growth. School districts everywhere are scrambling to "get connected" so that teachers and students will have access to this treasure trove of information. The WWW seems to hold great promise as an educational enhancement. However, specific and effective uses of the Web in the classroom have only begun to be documented. For the Web to achieve its potential as the focal medium of the "Information Age," the development of content and methods must be informed by how they are used and what users learn. This project has been designed to create specific WWW-based lessons and to document and assess their use in pilot classrooms.

Live from Earth and Mars curricula is constructivist-oriented and uses the power of the Internet to explore science and engineering concepts. All lessons utilize data captured from Earth-orbiting satellites and interplanetary spacecraft. Eight sets of science lessons that target specific grade levels (for grades 2–12) have been field tested during the 1996–97 academic year. These materials are based on Washington State's *Essential Academic Learning Requirements*, Project 2061's *Benchmarks for Science Literacy*, and the NRC's *National Science Education Standards*. The WWW-based lessons encourage online exploration of data and provide suggestions for offline supporting activities.

During the summer of 1996, the project staff hosted a 3-week long curriculum development institute for local teachers. Participants learned atmospheric and space science concepts, explored the WWW as a teaching tool, and wrote interactive curriculum modules. Pilot teachers, including summer institute participants, met regularly during the 1996–97 academic year to discuss classroom implementation of the lessons, to recommend revisions and to explore related pedagogical issues. Project staff worked intensively with each pilot teacher to prepare and implement the electronic lessons, including extensive classroom observation. These on-site observations have produced an initial assessment of classroom use of Internet-based lessons as an instructional tool, which will be described in detail during the poster session.

This session will present a review of the creation and implementation of the WWW-based curricula. We will examine the process from participating teachers' initial exposure to the WWW as a teaching tool to the assessment of outcomes. Selected activities from the interactive science lessons will engage session participants in sampling the project Web site.

Spotlight Session

Ten Big Questions for Educational Technology—With Some Big Answers

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Key Words: **educational research, funding, learning technologies, science education, math education, engineering education, technology integration**

Ten BIG QUESTIONS are dominating current discussion about educational technology:

- How do we pay for multimedia-capable, Internet-connected classroom computers for every two to three students?
- How can my school afford enough computers and telecommunications?
- How do I get my colleagues involved with educational technology?
- How do we move our community beyond traditional ideas about teaching, learning, and the role of schools?
- How do we prove to our community that new technology-based models of teaching/learning are "better"?
- If we use technology well, what should we expect as "typical" student performance?
- What comes next after the World Wide Web?
- How can educational technology increase equity rather than widening current gaps?
- Where can I get external funds for innovation?
- How can I keep up?

Finding BIG ANSWERS to these questions often involves rethinking underlying assumptions about learning and schooling. For example, a two-part answer to "How do we pay for multimedia-capable, Internet-connected classroom computers for every two to three students?" is:

> Part One: **We cannot!** This vision is impractical economically, from a teaching/learning perspective, and in terms of equity. All money for educational innovation would drain into a bottomless pit of continually evolving hardware, leaving teachers unprepared to use these devices. Moreover, too much emphasis on unreflective assimilation of information is likely to result from such a classroom situation. Finally, schools that serve communities with low socioeconomic resources can get higher leverage in improving students' lives through more balanced patterns of educational expenditures.
>
> Part Two: **We should not!!** Students staring into monitors all day with teachers wandering around to help as needed is the wrong model for the classroom of the future. Instead, we should foster "distributed learning" that builds partnerships among teachers, families, business, and communities. We should complement affordable amounts of classroom-based technology with information infrastructures outside of schools, such as television, videogames, and Web-TV. Through the entertainment and information services industries, powerful information technologies are becoming common in homes and communities, even in economically disenfranchised areas. The crucial challenge is to

re-purpose media not purchased for educational reasons. (For more ideas about distributed learning, please see my testimony to Congress, which is downloadable from my Web site at www.virtual.gmu.edu)

Similarly, the question, "How can my school afford enough computers and telecommunications?" too often means "*Without changing anything else*, how can my school afford enough computers and telecommunications?" Rephrasing this to ask instead, "How do expenditures alter when educational technology is used effectively for teaching and administration?" enables reconceptualizing how resources are allocated. For example, with exemplary technology usage money can be saved on textbooks, less support staff for data management are needed, less re-teaching of the curriculum is required, and new patterns of student/teacher ratios become possible.

This session describes possible BIG ANSWERS to many of these BIG QUESTIONS. National Science Foundation programs that provide external funding for innovations will also be discussed. Further information on these funding programs can be obtained from the NSF Web site: red.www.nsf.gov

General Session: Technology Implementation/Educational Reform

An Overview of the National Science Foundation's New Funding Programs

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Key Words: **educational research, funding, learning technologies, science education, math education, engineering education, technology integration**

The National Science Foundation has initiated a new funding program, "Research on Education, Policy, and Practice" (REPP). This program supports cultivation of a research base for implementing innovative K–16 reform strategies, as well as ways to improve graduate, professional, and informal and lifelong learning. In welcoming proposals that will break new ground in thinking about education, REPP complements NSF-wide initiatives on "Collaborative Research on Learning Technologies" (CRLT) and "Learning and Intelligent Systems" (LIS). The central focus of all these programs is science, math, engineering, and technology education.

Questions such as the following indicate an illustrative range of research possibilities that these programs support:

> *How do people learn? What does "conceptual development" mean in the progression from basic skills to higher-order thinking? How does technology change how people think, learn, approach, and solve problems? What does a "constructivist" classroom look like? How can schools be reorganized to encourage this type of instruction?*

The following themes are the main research foci for addressing these questions:

> *Practice:* How those at the sites where formal or informal education occurs can effect change through research and analysis. How observations, findings, and prototypes generated at particular sites can be applied to hypothesis-testing and theory-building more generally about the practice of systemic reform.

Technology: How tools that link individuals and institutions dispersed in space and across cultures can be used to teach and learn the changing content of science and mathematics; how the evolving capacity of computers and other technologies enables teachers to individualize instruction and students to engage in the processes of experimentation, of understanding, of skills acquisition, and of applying content knowledge; and how high performance computing and communications empower the effectiveness if educational administrators, policy makers, and researchers.

Data, methodology, and theory: How the collection of measurements and their presentation, use, and interpretation can inform researchers and decision makers.

Policy: Issues of governance that affect both ongoing practice and the perception of whole systems, schools, teachers, and students (including matters of finance, access, curriculum, assessment, professional development, etc.).

This session will describe the priorities of NSF's new funding initiatives and invite the involvement of practitioners in these efforts. Further information on all these funding programs can be obtained from the NSF Web site: red.www.nsf.gov

General Session: Technology Implementation/Educational Reform

Using the Internet—From Learning Beginning Skills Through Integrating Quality Online Resources Into Existing Required Curriculum

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Key Words: **mentoring, collaboration, math, science, Internet, lessons, distance learning**

The Reach for the Sky Project and Network Montana Project serve the needs of the classroom teacher who seeks to acquire Internet skills, collaborate with and mentor colleagues, and make use of valuable Internet resources in conjunction with required curriculum in order to enrich the educational experiences offered to students.

The Reach for the Sky Project, a five state project, has made resources available for teachers to learn basic Internet skills, learn to collaborate on the Internet, and to acquire online mentoring skills. As a result of this three-year project sponsored by Annenberg/CPB Math and Science

Project and US WEST Foundation, online Web based courses are available. During this study, the effects of acquiring and learning Internet skills and of participating in online telecollaborative activities in classroom situations has been document and will be presented. A primary goal of the project was to determine how involvement with telecomputing and telecollaborative activity affects various classroom structures including inclusion classrooms. A secondary goal was to determine the success of and future ramifications for online mentoring and the process to create and train online mentors. Our findings will be presented.

Once educators have online skills and have learned the value of telecollaborative activity, quality curricular online materials are essential. The Network Montana Project is a collaborative, systemic research and development project. The goal of this NSF/NIE program is to build synergy among technology and educational researchers, developers, and implementers in the use of network and telecommunications technologies in education.

The Network Montana Project is collaborating with NASA on the development of a collection of classroom activities having Earth System Science (ESS) as a common theme. Integrating science, mathematics and technology; these activities will introduce K-14 students to the vast information resources on the World Wide Web. Teachers working in four teams (Novice, Intermediate, Advanced, and Expert) have been collaborating to create exciting classroom activities that make full use of today's educational technologies and the Internet. The main categories for these activities are the Atmosphere, Geosphere, Hydrosphere, and Cryosphere which are available on the Network Montana Project World Wide Web information server. Using the same procedure, the second phase of the project expands to include the study of pristine environments compared to polluted, or degraded environments. The pristine environments included will be Yellowstone National Park and Glacier National Park.

These projects serve the needs of classroom teachers who seek to acquire Internet skills, mentor colleagues, and make use of valuable Internet resources, in conjunction with required curriculum in order to enrich the educational experiences offered to students.

General Session: Exhibitor Presentation/New Curriculum Designs/Instructional Strategies

Developing Online Science Curriculum With PSL Excelerator and Microsoft Excel

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Key Words: probeware, multimedia curriculum, PSL Excelerator, Microsoft Excel, microcomputer-based labs, science, math, technology

Description

Learn how to create truly interactive, multimedia curriculum materials with the use of PSL Excelerator and Microsoft Excel in the secondary science and math classroom.

Summary of Workshop

PSL Excelerator is Team Labs latest software product that has revolutionized the use of computer-based probeware in the science and math classroom. As an add-in to Microsoft Excel, it combines the best features of real-time graphing with the powerful analysis and charting features of Excel's spreadsheet environment. In terms of curriculum development, it provides an easy to learn curriculum platform that enables teachers to author online materials with imbedded audio, video, and graphics. In essence, the spreadsheet replaces the students traditional lab notebook with a much more powerful, interactive work environment.

The session will involve hands-on experimentation for all of the participants, along with an in-depth discussion and review of the opportunities this software provides educators who wish to author online, multimedia experiments.

Traditional Poster Session

Robotics for the Rest of Us

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Key Words: **education, robotics, constructivism, technology**

Imagine your students' excitement when they discover that they are going to build (and program) their own robot! Recent advances in technology have made this idea not only possible but affordable, as it is now possible to purchase off-the-shelf components such as microprocessors, sensors, and motors.

Your students may decide to build an automated vending machine, a robotic sentry, or a roving fire-fighter. Mine chose to design and build a robotic fireman with the goal of entering their project in a robotics contest that was being held in Hartford, Connecticut.

The Process

Begin with a problem statement. According to contest sponsors, our design had to navigate a maze, seeking (and extinguishing) a lit candle. It could be self-contained or connected to an external CPU via harness or radio control. It could use any means to extinguish the candle, but it could not knock the candle over or damage it in any way.

Form teams of students and assign each team a specific task. Using the robotic fireman as an example, the following groups were formed: sensors, navigation, construction, programming, and termination (extinguishing the candle). Each group had a specific goal to accomplish and faced unique problems.

For example, the "sensor" group conducted research to determine to best type of sensor to use to locate the flame, one that would not be affected by infrared beams of autofocus cameras. They were also responsible for the contact sensors located on the robot's body to indicate contact with walls (and the candle).

Members of the "navigation" group worked closely with the "programming" group. Their task was to guide the robot through the maze, scanning each of rooms for the presence of a flame. Early into the project students discovered that identical motors weren't identical in terms of rpm—their robot would not move in a straight line—and they had to write a program to compensate by turning one motor off for brief periods of time.

Members of the "construction" group were given the unenviable task of integrating ideas from the other groups into a single unit. At the time, this meant telling a group that their idea was impractical, given the constraints one the design.

A means had to be found to extinguish the candle once it was located. Air, water, foam and explosion were considered. Members of the "termination" group experienced the compromises engineers make as they deal with limitations of size and weight. For example, a small fire extinguisher would work well, but its size and weight would require larger motors which in turn would require larger batteries.

What Students Learn

Students are initially afraid to take chances due to a fear of failure. Early into the project they discover that failure is an integral part of the engineering process and should not be feared. Over time, they learn to view failure as part of the learning process and to respond appropriately.

Projects of this type provide students opportunities to experience first-hand the complexities of problems faced by mechanical and electrical engineers. Problems faced by students have multiple solutions and teams must work together cooperatively, since changes made by one group may affect others.

Role of the Teacher

In projects of this nature, the role of the teacher changes from source-of-all- knowledge to that of facilitator, from giving information and making decisions to asking questions and observing.

General Session: Society Session/New Curriculum Designs/Instructional Strategies
(Organized by ACM SIGCUE)

Computer-Based Concept Mapping as a Tool for Teaching and Learning

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Key Words: **concept mapping, electronic studying, strategies**

This presentation will provide an overview of both student-centered and teacher-centered strategies for using computer-based concept mapping in the classroom. The strategies have been validated in elementary and secondary classrooms over the last three years and are teacher-tested for success. Strategies include brainstorming, concept formation, project planning and cooperative learning. The strategies can be implemented with any number of concept mapping software programs on the market, but take particular advantage of features embedded into the program known as Inspiration (Inspiration Software, Inc.). Presenters will also share and illustrate a new tool for assessing concept maps electronically, one of the biggest stumbling blocks for teachers wanting to integrate concept mapping into the curriculum. Materials with step-by-step instructions for implementing some of the strategies will be provided to all attendees.

General Session: Exhibitor Presentation/New Curriculum Designs/Instructional Strategies

Cooperative Learning and Technology

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Key Words: **cooperative learning, technology, communication**

True cooperative learning involves more than simply putting students into groups. It also involves more than taking turns with a limited resource, like a computer. Collaborative learning succeeds when students within a group really depend on one another. It's not just a matter of waiting for the student to do all the work; everyone needs to be engaged and contributing. Communication is the key. When students talk to each other, explain content and concepts, and negotiate a common understanding, strong, powerful learning is the result.

This kind of cooperative learning can support education across the content areas, and technology can help. This workshop examines ways that all types of technology—computers, videodisc players, CD-ROMs, networks, and the Internet—can support successful collaborative instruction.

The presenter, David Dockterman, Ed.D., is author of Great Teaching in the One Computer Classroom (1989, 1990, 1991, 1996) and Cooperative Learning and Technology (1994). During the workshop, he will model a variety of cooperative learning approaches that actively involve participants. Teachers will see how mixing media can give students unique and essential information; how controlling the flow of data can reinforce a valid division of labor; how distance can be a great way to bring students together; and how it can all be assessed.

David Dockterman is vice-president and editor-in-chief of Tom Snyder Productions, a leading publisher of educational software and CD-ROM. The company's products are designed for grades K–12 and promote discussion, problem-solving, reading, writing, and interdependence.

General Session: Exhibitor Presentation/New Curriculum Designs/Instructional Strategies

Hands-On Science, High Drama, Humor

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Key Words: **multimedia, hands-on science, mock trials, humor**

A new series of multimedia CD-ROMs from Tom Snyder Productions takes students to court; science court. Is Matt Middleton guilty of false advertising? Does his trash smasher really provide massive trash reductions? Could it be that little Jenny Almond is guilty of attempted murder? Or was the object she smashed not alive? The Science Cops have arrested Carlo Benz for wanton destruction of property. Will the jury find him guilty?

Over the course of each dramatic trial, expert witnesses model scientific experiments and explain scientific concepts. Students, working in cooperative teams, take the role of courtside commentators, analyzing objections with their own hands-on demonstrations. Students predict how the judge will rule and the jury decide.

The adversarial nature of the courtroom provides an enticing dramatic context to introduce and illuminate basic science concepts, such as mass and volume, density, gravity, classification, erosion, and much, much more. Each case illustrates science in action with clear, understandable examples. Science Court mixes strong characters, sharp dialogue, and humor to draw students into a world where the laws of science reign supreme. Students must work together to ensure common understanding of science content and science process. Built-in hands-on experiments prompt students to do science themselves, and all within the compelling and meaningful context of the trial.

The CD-ROM based series is designed for classroom use on Macintosh and Windows platforms. The hands-on tasks rely on readily available materials that can easily be duplicated at home.

Science Court is one of the newest CD-ROM products from Tom Snyder Productions, a leading producer and publisher of educational software and CD-ROM. The company's products are designed for grades K–12 and promote discussion, problem-solving, reading, writing, and interdependence.

Spotlight Session

Adapting for Technology: Coast to Coast

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Key Words: **tech team, integrated curriculum, project-based learning, student centered learning, leadership, educational reform, technology considerations**

We are engaged in an educational revolution that has been developing for the past 100 years. The ingredients for change are gathered.... Technology may be the tool that makes it happen.

Long before Shepaug or Town School had fully articulated technology plans, Ted and Leni were discussing the ways computers changed classroom experience and designing online experiences that put those into practice. From opposite ends of the country, Leni and Ted have worked with disparate school populations, dissimilar buildings, and different educational climate.

They hold common beliefs about education, however, and have forged programs with common core but different implementation strategies.

At Shepaug School, the competencies culminating in the Senior project described the reforms the community wanted to bring about. At Town School a plan based on documented best practices was developed and has been evolving in implementation over the last three years.

Shepaug School Competencies and Clarifications Definition of Competency:

> *Student competency is a quality of mind, character and behavior which permits an individual to effectively fulfill the civic, vocational, ethical, and interpersonal roles of a mature modern-day adult.*

Areas of Competency

1. Self-Educating/Autonomous/Lifelong Learner
    - actively initiates learning activities when we step back.
    - pursues knowledge/learning beyond our requirements.
    - is intellectually curious.
    - is open minded.
    - draws from a range of experiences and knowledge.
2. Interpersonal Skills
    - has a sensitivity to and an understanding of the needs, opinions, concerns, and customs of others.
    - participates actively in reaching group decisions.
3. Ethical Values
    - is honest... especially with respect to academic achievement, i.e., with consideration to, but not limited to, lying, cheating, and plagiarism.
    - exhibits a sense of accountability and responsibility for his/her words and actions.
    - honors the universal code: Do unto others what you expect others to do to you.
4. Adaptability
    - can accommodate to various situations and people without compromising integrity.
    - recognizes the difference between those situations which require modification on his/her part and those which do not.
    - is aware of the changing world around him/her for the purpose of making rational decisions about adaptation.
5. Global Awareness and Stewardship
    - is aware and knowledgeable about environmental problems.
    - has a local-to-planetary perspective and concern.
    - understands how our culture relates with other cultures.
    - does not inadvertently suppress or ignore importance of our own culture.
6. Creative Problem-Solving
    - understands that the process begins with framing both clarifying questions and a statement of the problem; and also includes collection of relevant information, analysis and evaluation of the information to form a solution.
    - recognizes that there may be a multitude of solutions and that optional processes such as lateral or divergent thinking and brainstorming may reveal those solutions.
    - is able to accept ownership of the problem.

  - is able to evaluate the solutions for consequences expected or unintended and opportunities, recognizing that the easy solution is not always the best solution.
  - is able to recognize when to stop and when to continue attempts to solve problems, and recognizes that problem solving continues beyond implementation to evaluation.
7. Self-Worth (Confidence)
  - has confidence to make his/her own decisions.
  - has a sense of belonging (socially).
  - recognizes self-value in spite of negative external messages or pressures.
  - has ability to recognize strengths and weaknesses and to use these to establish a sense of direction.
  - when experiencing failure as well as success and can maintain high self-esteem.
8. Commitment
  - is energetic toward "purpose."
  - shows ability to set short and long term goals.
  - indicates skills in problem solving strategies.
  - exhibits perseverance.
  - A student who indicates a commitment shows a distinct sense of direction (a purpose) in life.
  - Commitment indicates the act of achieving.
9. Effective Communication
  - expresses what she/he intends.
  - expresses him/herself in a wide variety of situations and through a wide variety of modes including: written, oral, visual, and physical.
  - assesses how he/she is perceived by others (audience of 1 or 1,000) and when necessary.
  - adjusts and refines the original mode, and/or changes modes.

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Online Projects From *The Electronic SchoolHouse*

http://electronic-schoolhouse.org

The projects of the Electronic SchoolHouse are the work of many teachers. Here is a sampling...

- **Westward HO!**: Yee ha! Warp back to the 1850's and hitch up your wagons for the trek of your life. Each year a virtual wagon train faces the hazards of the Oregon Trail.
- **Postcard Geography**: classes use snail mail to collect picture postcards from other online classes and enhance the learning of geography.
- **Geography Detectives**: classes fill boxes with clues to their location. Paired classes exchange boxes via snail mail and then go online to ask questions and solve the mystery.

- **Classroom On Ice**: Field trips anyone? For several years students have linked with Frank Ball and learned what winter was like in the South Pole. They have also followed bicyclists on their journey through Central America and kayakers running the upper Nile.
- **Math Online Games**: measuring, counting, analyzing, and writing math word problems plus the fun of online competition
- **The Egg-a-Thon**: a major spring event including a cross-country egg toss, an art egg relay, egg recipes, eggcellent poetry, and much more. And, the egg drop itself has become an online event with schools participating from all across the country.
- **ScrapBook Writing Project**: Begun in 1989, 260 classes in 35 states have linked, exchanged essays, and added chapters to the ScrapBook Library.

Traditional Poster Session

LALCNet: Los Angeles Learning Community Network

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Key Words: **low-income grants, Internet access, schools-communities connection**

Department of Commerce Funds LALCNet to Help Parents and Community Get Online

Los Angeles Learning Community Network (LALCNet) was awarded a grant by the U.S. Department of Commerce to expand Internet access in low-income school communities. The grant will be used to develop four school and community electronic access centers in the urban communities of Los Angeles. Schools, parents, students, and the community agencies they serve will all be involved. As a result these underserved populations will have better, more timely, and cost-effective access to school and community information and services. This places schools at the forefront of the effort to increase access to the Internet for members of low income communities. In doing so it is helping to build a stronger bridge between schools and their communities that we believe will help to improve students learning.

LALCNet was developed for teachers by teachers. It provides low cost access to the Internet and the capacity for educators across Los Angeles County to reach beyond the walls of their classrooms to their colleagues and community resources from home or school. LALCNet gives them a versatile new tool to talk to each other as well as find interesting learning activities and content. Teachers can enrich their classroom environment, access professional development opportunities, ask questions of a colleague across town or on the other side of the world. Electronic forums (newsgroups) allow access to experts and others with similar educational interests. There are ready-to-use, hands-on student projects in math and science developed by southland educators.

The Poster Session will enable participants to engage in informal discussions with members of the development team. Topics of discussion will include how the School Based Electronic Access Centers in Los Angeles are being implemented and accessed by the community. Training plans will be shared with interested participants as well as some of our lessons learned. Presenters will share the creation of a network from an instructional and technological point of view, how they provide access to the WWW, a plan for training of teachers and parents in technology, and how it all applies to the instructional environment.

We will have demonstrations of LALCNet and samples of products created at our learning centers available for viewing at the poster sessions.

General Session: Technology Implementation/Educational Reform

TEAM: A School, University, and Community Partnership

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Key Words: **collaboration, partnerships, staff development, change**

Description

This session will focus on a model of staff development in technology that can serve as a vehicle for re-envisioning schools and schooling for the 21st century.

The focus of this presentation is a partnership between the Department of Educational Technology at Long Island University and the Half Hollow Hills School District. For the last two years we have been offering an on-site version of our TEAM program (a Master of Science program in Computers in Education) at the Half Hollow Hills School District with over 50 district teachers participating to date. Through this partnership, we have been able to customize the program to address specific technologies and platforms supported by the district, in addition to developing a large core of teachers who are skilled in technology; have participated in building a collaborative learning environment among themselves and with the larger community; and who share a common vision of how technology can reshape education and effect positive change.

The session will be a panel composed of university and school district participants. Attending will be two full-time faculty members of the Department of Educational Technology at Long Island University, the Half Hollow Hills Associate Superintendent, District Technology Coordinator, and one or more district teachers who are also TEAM students. Our goal is to explore ways that aspects of this program can serve as a model for implementing staff development in technology that goes beyond skill acquisition and addresses how technology can serve as a vehicle for re-envisioning schools and schooling for the 21st century.

Key topics covered will include:

TEAM: Our two-year master's degree program called TEAM (the acronym originally stood for Technology, Education And Multimedia), now in its sixth year, has evolved from a technology centered program begun in 1983 to a program that focuses today on ways in which technology can be used to promote collaboration, outreach, and individual leadership for shaping and building learning communities. Cohort groups of approximately 20 students each and a faculty mentor team meet in-person for four hours each week for the six semesters of TEAM but are online with one another throughout the two years. All TEAM members must have a computer and modem. We have graduated six TEAMs and have eight running at present.

OUTREACH: We reach out beyond the school district and its TEAMs as graduate students are linked to other TEAMs, linked to the global community via the Internet and World Wide Web, and have unique opportunities in a community wide learning community we have created called Long Island Team. The Long Island Team is a collaborative learning community, where learning partners envision within a technology-rich environment, a place where learning is exciting, collaborative, and contributes value to society. Long Island Team connects teachers, administrators, and students in public and private K–12 schools, Long Island University faculty and students, local business and industries (e.g., Newsday Direct, Long Island's newspaper now online, Cablevision, and NEC Foundation of America), and community and cultural resource participants (e.g., nature preserves, historical societies, museums). Spanning more than 100 miles across Long Island, participants see themselves constructing a learning system that sees beyond traditional boundaries of organizations or local communities and, yet, celebrates what is rich and unique about each. All participants have access to one other electronically with telecommunications conferencing, e-mail, and now a World Wide Web site. With an Excellence in Education award from NYNEX, Long Island Team is creating the Electronic Educational Village, a place to dream and construct learning activities with "citizens" of its community. Half Hollow Hills and Long Island University are co-creators of the Long Island Team.

CREATING SCHOOL CULTURE: The creation of a technology-rich culture within a school district, one that fits naturally and powerfully with the goals and objectives of the district and the state, will be discussed. Active users of technology partner with one another within buildings, between buildings, and across age levels. Rather than technology training as a tack-on, using technologies becomes activity-driven and supported by a network of TEAM members who function collaboratively with others within a comprehensive school philosophy and vision.

OUTCOMES & THE FUTURE: Results achieved in Half Hollow Hills within this unique partnership will be assessed along with plans for future TEAMs. Of interest will be the development of more substantive and authentic evaluative procedures to better document outcomes and the continued conversation of what matters, what works, and what might be developed within and for the district. Focus will be on envisioning schools and schooling for the 21st century as we learn from our experiences jointly.

General Session: Technology Implementation/Educational Reform

The Internet, The Arts, and Educational Change: The ARTSEDGE Experience and What the Arts Have to Offer

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Key Words: art, arts, education, Web site, ARTSEDGE, Kennedy Center, curriculum, Goals 2000

Introduction

The goal of this presentation is to share the lessons of ARTSEDGE, a unique project begun at the Kennedy Center for the Performing Arts in 1991. This project was intended, in part, as a means to implement education reform, the Goals 2000, and the National Standards for the Arts. As such, it was one of the first curriculum initiatives on the World Wide Web, and continues to serve a unique role in helping teachers implement curriculum on a national scale. The evolution of the ARTSEDGE project and the Internet will be shown to parallel education reform.

But ARTSEDGE also has another crucial role in reform. It is a source of tools and resources to help all teachers integrate the arts in K–12 curriculum and to help all educators understand the arts (Dance, Drama, Music, and Visual Arts) as core subjects. The central role of the arts in the ARTSEDGE project will be shown to parallel the central role the arts can play in implementing new curriculum initiatives and addressing the problems inherent in both technology and reform.

ARTSEDGE Beginnings: Building an Online Knowledge Base for Arts Education

In 1991, the National Endowment for the Arts made funding available for an organization to develop strategies for the national dissemination of information about exemplary arts education programs. The Kennedy Center's Education Department was selected to conduct the study in conjunction with its role as the national performing arts center with a significant education mission. As a result of interviews with educators and a study of how the Internet was being used for developing and disseminating educational tools and resources, the Kennedy Center proposed the development of a national Internet-based network. This also coincided with a report presented to the Secretary of Education which outlined strategies for integrating the arts in national education reform—of which the first recommendation was the development of an online clearinghouse.

The Kennedy Center established a cooperative agreement with the National Endowment for the Arts (with additional support provided by the U.S. Department of Education) in 1993, to develop the national arts and education network on the Internet, which was named ARTSEDGE. During the initial prototype phase, content was developed in cooperation with several pilot sites throughout the nation and with schools and arts organizations in the metro Washington community. With the advent of the World Wide Web, ARTSEDGE staff and consultants also drew upon the Kennedy Center artists and resources to develop multimedia content.

The Role of the Internet—The Gopher Site

Because ARTSEDGE was on the scene so early as a national force for implementing K–12 curricula, the history of this project gives a unique perspective on the role the Web can play in curriculum development and implementation. This presentation will review the history of this project and study the patterns which emerge. It will also attempt to identify some of the implications of these patterns for the roles of the arts, technology and the World Wide Web in curriculum implementation.

Several things characterize the early emergence of the Internet as a means of information distribution that distinguish it from the later World Wide Web. The most obvious of these is that the medium was brand new. Being new meant that the pioneering efforts like ARTSEDGE, had not only no other models, but also had no other base of information on the network from which it could draw content. Being the one of the only sources of arts education information in the gopher world, ARTSEDGE had to amass a large pool of information which would be useful to its constituents.

As a result the initial task was to contact a non-electronic network of organizations and information sources and to ask them to submit information which would have relevance for curriculum implementation. The Kennedy Center was in a unique position to collect this information. Because it had established a national network of arts organizations, it went to these groups and asked for specific information on the programs and contact information. Teachers across the country could access this information and contact local arts groups, bringing the arts community into the schools as partners in curricular programs for the arts.

The kind of information that was gathered in this early gopher format was text based and served largely as a directory to non-electronic sources of information. This included lists of educational resources, publishers, arts organizations, program profiles, etc. This information was submitted by partner groups or collected from print sources, entered by hand in long list, which were catalogued and sorted according to whatever system seemed to fit the data. Some were sorted alphabetically, some geographically, some by art discipline. The information was simply placed on the server, waiting for interested parties to access it like a library reference for arts curriculum implementation.

ARTSEDGE developed a very extensive catalogue that became a major source of arts education information online. Like any catalogue, people referred to it to find specific information, but it was not exactly exciting reading. Also, access was only available and of interest to a relative few.

Then in 1993 the explosion came. With the introduction of Mark Andreesen's "Mosaic" browser and the "World Wide Web," a brand new online medium came into being. Suddenly everyone was excited and wanted to be online. ARTSEDGE began its Web presence in that same year, establishing its own domain and bringing on designers to create an interface that would take advantage of the exciting graphic capabilities of this new technology.

The Emergence of the World Wide Web

At first, the emergence of the Web did not radically change the nature of the information represented. With a virgin cyber landscape, catalogues of information were erected to fill the void, albeit with the novel addition of some graphic decoration.

Very quickly however, two influences began to change the landscape radically. First of all, the graphical and interactive possibilities of the Web demand a correspondingly graphic design that engages the user. This is especially true when the topic is the arts. Secondly, the explosion of Web sites and Web users meant that a vast array of new information was appearing on the Web daily from every conceivable source. Availability also grew phenomenally.

As this trend continues the pressures to keep up with the new information appearing on the Web began to overwhelm the collection of data from arts and education groups. The role of a Web site like ARTSEDGE, with a mandate to be a national clearinghouse of information has begun to change. Compiling the information itself becomes both less feasible and also fortunately, less necessary. As other arts groups and teachers begin to produce their own information networks, the role would seem to be to compile *sources* of information and developing new ways and means to access and use the information.

The Changing Web We Weave: The Web as a Metaphor for Education and Curriculum Reform

It is my thesis that these changes represent more than the natural growth of a new information medium. The new ways of compiling this information are a metaphor for the changes we are seeing in American education. The kinds of change we discuss in schools that are related to those we see on the Web include:

education	—change from simple rote learning to problem solving, and meta learning or "learning how to learn"
Internet	—changes from information compilation to finding ways to assimilate and access information
education	—changes from text-based learning to multiple learning styles
Internet	—changes from text information to multimedia applications
education	—changes from content based on canon to student-interest based learning
Internet	—changes from central sites compiling information to pointing to a broad base of alternate information sources
education	—changes from teacher centered lecture to active and "authentic" learning
Internet	—changes from passive information sources to interactive applications
education	—changes from Euro-centric content to multicultural awareness
Internet	—changes from military/university use to growing global access
education	—changes from discrete subject areas to integration
Internet	—changes from simple text to hypertext

The Challenges of the Net

But the changes represented on the net also reflect some of the difficulties of change in education and society. There are also problematic changes which are parallel including the following:

education	—changes from public funding to some need for commercial funding
Internet	—changes from public information sources to confusion of public and commercial sources
education	—changes from common general education to magnet schools
Internet	—changes from simple ASCII text standard to multiple HTML standards

Access is still an issue.

education	—changes from the exchange of information between people to a computer intermediary
Internet	—changes from simple information source to all engaging "virtual reality"

The Role of the Arts: The Arts as an Agent of Reform

The uniting thesis of this presentation is that the arts play a crucial role in educational and technological change. ARTSEDGE is not simply an early pioneering initiative in curricular implementation via the Internet, it represents the arts in education and on the Web. As such it has a central role to play in addressing the major issues outlined above. The arts can be an agent for addressing the issues and needs of reform, including support for problem solving skills, multiple learning styles, understanding multimedia, active learning, multicultural awareness, and integration.

They are also vital in addressing the problems we face including coping in an increasingly complex society, media education and awareness of commercial interests, creating cultural strength in diversity, and humanizing the technological experience.

The arts have been considered the measure of a society and culture throughout history. Our society tends to marginalize the arts. In spite of this, the arts continue to lead our society in both technological and educational innovation, as ARTSEDGE demonstrates. This leadership role that ARTSEDGE plays is also a metaphor for the importance of the arts in education reform and must be reflected in the representation of the arts in the core curriculum. We ignore the central contribution of the arts to both technology and education at our peril. ARTSEDGE can help lead the way.

General Session: New Curriculum Designs/Instructional Strategies

Teacher/Pathfinder: An Educational Village

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Key Words: **teacher/pathfinder, curriculum resources, innovation, professional development**

Our goal: Easy access and equal access to educational resources on the Internet for teachers and learners to promote lifelong learning.

What is Teacher/Pathfinder?

Teacher/Pathfinder is a World Wide Web site for teachers designed to provide easy access to curriculum resources on the Internet. It is funded by the U.S. Department of Education Funds for Innovations in Education, #R215J40024-96. Through strategic alliances, Teacher/Pathfinder supports educators and prepares learners for the 21st century by integrating information and technology to meet the challenges of a global society.

Where is it?

The Teacher/Pathfinder Educational Village address on the World Wide Web is:

http://teacherpathfinder.org

Who is Developing Teacher/Pathfinder?

Members of the National Education Alliance for Technology (NEAT), led by the Redondo Beach Unified School District, are collaborating on the development of Teacher/Pathfinder.

Collaborations include the Association of Educational Communication and Technology (ACET); the American Association of School Librarians (AASL); the National School Boards Association (NSBA); the National Education Association (NEA); the Educational Resources Information Center (ERIC) Clearinghouses on Information & Technology and on Elementary and Early Childhood Education; Foresight Education and Technology, Inc.; the Los Angeles County Office of Education TEAMS Distance Learning program and professionals from Montana State University and Tribal College Libraries; University of California at Irvine; the HITLAB, University of Washington; California State University, Dominquez Hills; Cerritos Community College; Development Associates, Inc.; El Camino Community College; Emerging Technologies; Futures Academy; Lutheran Schools Association; Montessori School System; National Council of Teachers of English; National Space Foundation; NetDay 97; Pepperdine University.

Why is There a Need for Teacher/Pathfinder?

While there are literally thousands of Internet sites for educators, finding the best sites is difficult. Teacher/Pathfinder provides easy access to educational resources which have been evaluated by both teachers and national educational organizations.

How is it Organized?

Teacher/Pathfinder—An Educational Village

http://teacherpathfinder.org

The Teacher/Pathfinder is funded through the Department of Education. Funds for Innovations in Education, #R215J40024-96, is a national partnership designed to provide tools for the educator to easily access resources on the Internet. Teacher/Pathfinder is a user-friendly comprehensive, pre-school-through-senior educational information center that includes lesson plans, projects, papers, discussion groups, periodicals, virtual trips, lists, local connections and multimedia materials.

- The Schoolhouse
  - includes such areas as "by subject" lesson plans, curricula, paths to reference and resource materials
  - includes such areas as Accelerated Schools, Goals 2000, Tribes, school reform, integrated cross-curricula, equal access to information programs, innovated Department of Education programs and projects and Department of Education successful sites
  - includes independent study, college and high school credit classes, private schooling needs, special groups, such as Native American, special needs such as blind, deaf, physically handicapped, ethnic and minority educational resources, etc.
  - includes programs and projects for the home-bound student, the home teacher, after school personnel, etc.
  - includes programs developed by national and state school-to-work programs as well as the Teacher/Pathfinder special projects sections
  - includes the student schoolhouse and the cybrary, a library-centered model which contains curriculum modules which are annotated for grade expectancy, district, state and national standards and are linked to teacher-appropriate support information, lesson plans and curricula
- **Professional Development** (includes training in accessing the Village buildings, accessing the Internet and the search engines; training in the incorporation of the Internet and other technologies tools for the educator; training in the use of the Teacher/Pathfinder and the Internet and other technologies for librarians, school media

specialists; training for parents and teenage; training in advanced technologies on the Internet such as Virtual Reality and Virtual Worlds)

- **The Support Offices** (includes assessment and evaluation tools, dissemination tools, support services administration, counseling and health, technical and troubleshooting inservices and training, policies and procedures in technology strategies, etc.)
- **The Community Center** (includes model consortia, model "town" projects, city-state and national-linking information, town pertinent information, etc.)
- **The Parent Building** (includes support materials for teachers-in-school lessons, for home teaching, and highlights such excellent projects as the National Parenting Information Center, Newton's Apple, ERIC Youth Access)
- **Serving teachers** (recognizes new projects which are highlighted weekly, the majority of which are being produced by the Teacher/Pathfinder partnerships. It also provides interesting commentaries for teachers including "sponges," topics for discussion and lesson suggestions linked to relevant teacher pathfinder sites)
- **Help** (provides help tutorials for the novice to the expert)

How Can I Use Teacher/Pathfinder?

To use this major national resource, you will need a computer, modem, and an Internet connection. Teacher/Pathfinder has links to resources for everyone interested in education. If you are a teacher, you may want to browse in the "training section" first, or look at curriculum resources (arranged by subject in the schoolhouse on the home page). If you are a parent or if you are interested in working with schools in your area, you will find information on school-community partnerships in the Community Center.

General Session: Improved Productivity/Administration

AskERIC: A Model for Providing Education Information

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Key Words: **K–12, Internet, question-answer services, lesson plans**

The award-winning AskERIC Service has been providing an Internet-based personalized education service for over four years. Because of AskERIC's reputation and experience, AskERIC serves as a model for related projects and services. This general session will briefly discuss the AskERIC Service for Educators, and related projects, including:

KidsConnect: Based on AskERIC's distributed question-answering model, KidsConnect is a question-answering, help and referral service for K–12 students on the Internet. The goal of KidsConnect is to help students access and use the information available on the Internet effectively and efficiently. Students use e-mail to contact KidsConnect and receive a response from a volunteer library media specialist within two school days. KidsConnect volunteers point students in the direction of sources to try. They do not give direct answers to questions. KidsConnect volunteers refer all students to their own school library media specialists for further assistance. KidsConnect is a component of ICONnect, a technology initiative of AASL (American Association of School Librarians, a division of the American Library Association)

AskLN: Another service based on AskERIC's model, AskLN is AT&T Learning Networks exclusive online mentoring service for teachers. AskLN is available to teachers through AT&T's WorldNet Service. AskLN allows educators to ask questions via e-mail and receive personalized online help about using the Internet and other technologies as effective classroom tools. The online mentors supporting AskLN are teachers with experience and expertise in integrating educational technology curricula into the classroom. They will answer other teachers questions via e-mail, in 48 hours or less.

Gateway to Educational Materials (GEM): The AskERIC Virtual Library has one of the largest and most used collections of lesson plans on the Internet. The primary objectives of this special project is to (1) establish a standard profile for describing and cataloging lesson plans, teacher guides, and other instructional units on the Internet and (2) apply the profile to major collections at several Internet sites in order to develop a one-stop access point which will allow teachers and other users to quickly search multiple sites distributed across the Internet and locate the materials they need. The GEM Project is funded by the U.S. Department of Education.

AskERIC: http://ericir.syr.edu/

KidsConnect: http://ericir.syr.edu/kidsconnect/

AskLN: http://ericir.syr.edu/AskLN/

GEM: http://ericir.syr.edu/~ilp/

Workshop

Evaluating and Exploring Presentation Packages

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Key Words: **presentation, HTML, Web page, HyperStudio, Digital Chisel**

Abstract

Would you like to experience evaluative previews of two of the leading presentation software packages in education today and receive free demo. copies of the software?

Do you want to learn how to transfer your presentation to the World Wide Web?

Are you an educator, administrator, or any other type of education professional who would like to see examples of presentations and obtain tips in developing presentations?

If you answered "yes" to any of the above questions, this is the workshop for you!

The **proposed agenda** for the workshop, as of February 28, 1997, is as follows:

I. A comparative analysis of "HyperStudio" and "The Digital Chisel":
  A. Prepared examples of each of the software packages will be shown.
  B. Presenter's nonbiased evaluation of the similarities and differences between the packages will be given.

II. A more indepth look at each of the presentation packages:
  A. Templates and tools will be reviewed.
  B. Screen/card design demonstrated.
  C. Adding digitized pictures, buttons, transitions, sound, hypertext links, QuickTime movies, animation. (Yes, this constitutes a majority of the instruction!)
  D. Application specific special features previewed.

III. Transferring / designing presentations for the World Wide Web.
  A. Comparative features of HTML transfer will be explained between the two presentation packages.
  B. Transferring presentations to HTML will be demonstrated.

IV. Design tips for presentations:
  A. A few design principles will be evaluated.
  B. Workshop participants will receive applicable handouts.

V. Individual/small group tutorial and experimentation time.
  A. Workshop participants will receive tutorial packets for each software package.
  B. Individual and/or small group time will be allotted for participants to explore the applications.

Appropriate and Shared URLs

A. URLs for each of the software companies; (More URLs provided to attendees):
1. The Digital Chisel:
  a. http://www.digitalchisel.com/—The Digital Chisel homepage
  b. http://www.pierian.com/—Pierian Spring Software compan
2. HyperStudio:
  a. http://www.hyperstudio.com/—HyperStudio homepage
  b. http://www.hsj.com/hsj.html—HyperStudio Journal on the Web

Traditional Poster Session

Using Today's Technology to Develop Tomorrow's Skills

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Key Words: **adult education, Internet, technology**

Abstract

This project focused on using project based learning to introduce adult students to the technology resources that many of their children were already learning to use in school. While the elementary, intermediate and high schools are making a major effort to incorporate technology in the curriculum (as per the SCANS 2000 recommendations), most of the adult students who are coming back to school for very focused reasons (to learn English, get their GED diplomas, etc.) very rarely have had any contact with computer or online technology.

Project Description

The goal of the project was to develop a Web site for the NYC Board of Education Adult Education Program. The basic Web site provides the following information:

- Information on programs offered by the Office of Adult & Continuing Education (BE, ESL, GED, Occupational Education).
- Focusing on/highlighting student successes.
- Establishing an "Adult Learners Network" for the program with an area devoted to providing local community information and information on special events and links to topics of interest for the students and their children. The site has a page devoted to each of the communities where the schools are located. The content was developed as a class project using a community treasure hunt for local resources and information on upcoming events. This section will be updated on a regular basis as students receive information about activities in their communities.

Background

The Web page was developed through collaboration with groups of students from Adult Learning Centers in three boroughs of NYC—Brooklyn, Queens and Manhattan. Working groups consisted of teams of students from each of the three learning centers participating in the project.

The student collaboration was conducted online—using "First Class"—the NYC Board of Education BBS. The students were able to communicate their ideas to adult learners at the other sites via e-mail and by participating in real time chats discussing what would go on the Web site. In addition, other classes were involved in a community treasure hunt to research information on community resources and services for posting on the community page.

Process

Students participating in the project started with an introduction to computers and online services—covering such topics as: what are online resources, what is the Internet, what is the World Wide Web, what is a browser, what is a home page. The students learned how to use the Internet for information gathering and research using search tools to find resume help & job information online and information for Black History and Women's History projects. The next step in the process involved working with small groups of students developing the information that would actually go on the Web pages for the program. In the final phase, the students collaborated online in chat rooms on the NYC Board of Education BBS to decide what would go on their Web sites, and using Web page construction software developed the actual Web pages for posting to the host site.

Paper Session

Code Reuse Through the Eyes of Students and Professionals

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Key Words: **computer programming, computer science, reuse of code, programming instruction**

Abstract

Beginning programming students often underestimate the importance of code reuse. In this study, I interviewed beginners and professional programmers about pairs of Pascal programs. One program of each pair included two logically identical procedures. The participants compared the programs on 1) ease of reading, 2) ease of debugging, 3) ease of maintenance, and 4) quality of design. Many of the students preferred the programs having duplicate procedures.

Introduction

Computer programmers have been concerned with code reuse for decades (ACM/IEEE-CS, 1991; Dijkstra, 1972). However, in my experience, the importance of code reuse, even code reuse within an individual program, is often underestimated by students in introductory programming courses. In view of the importance of code reuse, it is reasonable to assume that instruction can be improved when instructors gain a better understanding of students' attitudes toward code reuse. That assumption motivated this study.

Related Research

Program comprehension is important for programmers. Soloway and Ehrlich (1984) examined the role that knowledge of stylistic programming conventions play in program comprehension and concluded that experienced programmers' knowledge of stylistic conventions helped them to comprehend the programs that followed those conventions. Researchers have demonstrated close ties between program comprehension and program debugging (Gugerty and Olson, 1986) and between program comprehension and program maintenance (Soloway, Pinto, Letovsky, Littman, and Lampert, 1988).

Robertson and Yu (1990) liken reading a program for comprehension to a combination of reading a murder mystery and reading an instruction manual for a device. Readers of programs, like readers of murder mysteries must extract plans from scattered information. Readers of programs, like readers of instruction manuals must typically deal with a general formulation, not with a list of specific steps for specific cases.

The plan extraction involved in program comprehension may be difficult for novices. Programming experts focus on a general solution strategy and represent programs abstractly, whereas novices tend to focus on specific details (Mayer, 1988). Furthermore the mental representations of programs by novice programmers are more affected by superficial details of program structure than are the mental representations of programs by professional programmers (Boehm-Davis, Holt, and Schultz, 1992).

Dealing with general formulations may be difficult for novices. Fix, Wiedenbeck, and Scholtz (1993) found that experts' mental representations of computer programs had stronger connections between variable names for the same object used in different procedures than did novices' mental representations. Some novices find differences in names between the actual and formal parameters confusing (Madison and Gifford, 1996).

Other factors may affect novices' attitudes toward code reuse. Scholtz and Wiedenbeck (1992) found that even some experienced programmers attempting to write a program in a new language ignored functions and parameter passing because of the added complexity of learning about them. Hoadley, Linn, Mann, and Clancy (1996) investigated the extent of students' reuse of code when writing LISP programs. They found that students who were able to produce abstract code summaries were more likely to reuse functions than to duplicate code.

Method

This study examined beginning programming students' opinions of the advantages and disadvantages of code reuse, as exemplified by reuse of Pascal procedures. It used the opinions of professional programmers as a base of comparison. This study was part of a larger study that also investigated students' knowledge of Pascal and students' knowledge of and attitudes toward other stylistic conventions of programming (Fleury, 1991, 1993).

The 23 student participants in this study were volunteers from six sections of an introductory college course in Pascal programming at a large midwestern university. The four professional programmers were computer science doctoral candidates, each of whom had worked as a professional programmer for at least two years.

I interviewed each participant twice, once shortly after the students had written their first programs using procedures and once near the end of the semester. Each interview involved a pair of working programs. Like Soloway and Ehrlich (1984), I created stylistically poor programs for the interviews by taking an original program and modifying it slightly. In particular, I constructed the second program of each pair from the first by duplicating a procedure instead of calling it twice. Consequently the second program of each pair contained duplicate procedures, one for each of two salespeople. (See Appendix A for the relevant portions of one of the program pairs.)

The participants compared the pair of programs on 1) ease of comprehension, 2) ease of debugging and testing, 3) ease of maintenance, modification and extension, and 4) overall quality of program design. Both the students and the professionals explained the reasons for their comparative ratings, and I tape-recorded those explanations.

Results

The contrast between the students' ratings and the professionals' ratings was dramatic. No professional ever rated the program with duplicate procedures better than the program with the reused procedure. In contrast, more than one half of the students during the first interview rated the program with duplicate procedures as easier to read than the program with the reused procedure. More than one fourth of the students repeated that rating during the second interview. In fact during each of the interviews, more than one fourth of the students rated the program with duplicate procedures better than the program with the reused procedure on each of the three specific rating criteria, (ease of reading, debugging, and maintenance). However, a few more students thought that the program with duplicate procedures was worse in overall design than thought it was more difficult to read or to debug or to maintain. (See Appendix B for more detailed rating information.)

There were no discernible differences between the types of concerns expressed during the first and second interviews. During both interviews, the professionals and some of the students were concerned about code length and about the proliferation of procedures that might result from program extension. However, on other issues, the professionals' concerns and the students' concerns sharply diverged.

Professionals

The professionals pointed out that the existence of a separate procedure for each salesperson is misleading because it implies that the procedures treat the salespeople differently. The professionals were concerned about the repetitious work involved in debugging or modifying the duplicate procedures. They were particularly concerned about the likelihood of fixing one procedure without fixing the other or of accidentally changing one procedure without changing the other.

To split the procedure into two separate procedures is to suggest that A should somehow be treated differently from B.

You'll go to a lot of trouble to fix a bug and you'll fix it in one of these two places and two weeks later you'll pay someone to completely duplicate the effort of finding an obscure bug only to find out that duplicated code wasn't changed somewhere.

If I all of a sudden wanted to, instead of doing maximum, do minimum, I'd have to make changes to two places in the code and that's not an efficient use of my time.

And so it would be harder to maintain, modify, and extend in the long term because they might diverge. And also it would be important for people to realize they had to change both whenever they made a change to one. That might be knowledge that is lost over time.

Students

Many students thought that the program with duplicate procedures was better designed and would be easier to trace and hence easier to read and to debug. They liked the idea of being able to tell whose data the program was processing by determining which procedure was running. Some students suggested that the program with duplicate procedures would be easier to debug because you could compare the nonworking procedure to the other one, which hopefully would be working. Many students praised the program with duplicate procedures because it facilitated storing different types of information, making different calculations, or providing different output for the two salespeople.

Better to read, because it seems clear, you know. You can just say, "OK, that's AUpdate. That's done. It's BUpdate. That's done." It's like, more engineered.

Better.

You know when it's working on B and when it's working on A.

The procedures have the specific names so it's going to be easier to read, understand, and conceptually, I like the idea (of duplicate procedures).

It'd be easier to debug because you could see… which one it was going wrong with in the procedures.

If one works, you can just compare it to the next one. Then just rewrite it using B instead.

You could modify it easier this way… If you want to do something different to the letter B, you could change it. … Like if you wanted to find something different in just letter B instead of A.

I think obviously the A-salesperson and the B-salesperson are two different people, and their performances would be different. And with two separate procedures for them, it's going to be a lot easier to change their output.

Discussion

The professionals discussed the ease or difficulty of working with the programs throughout the programs' life cycles. They expected programs to follow certain conventions and found the programs following those conventions to be easier to read. They expected an abstract program formulation and saw the more specific duplicate procedures as requiring extra effort to read, debug, and maintain over time. Consequently, they gave the programs with duplicate procedures low marks for overall design.

Many students discussed the expected ease or difficulty of tracing the execution of the programs as they ran with one particular set of data. In contrast to the general formulation preferred by the professionals, many students expressed a preference for different procedures for different data. Nevertheless some of these same students, perhaps seeing the quality of program design as something imposed arbitrarily by texts and instructors, still gave the programs with duplicate procedures low marks for overall design.

In summary, the interviews indicated that many students saw abstraction, as exemplified by the reuse of a procedure with parameters, as a confusing obstacle. Professionals saw this abstraction as a useful tool. Many students saw specificity, as exemplified by duplicate code, as reassuring simplification. Professionals saw this specificity as a warning of difficulties ahead.

Suggestions for Instruction

We want students to internalize the points that the professionals conveyed in their interviews. Perhaps these points could be made by laboratory exercises better than by oral indoctrination. A sequence of maintenance exercises requiring changes to be made in duplicate code and in reused code may make a point. Laboratory exercises requiring students to identify duplicate code and replace it with reusable code may help to make students more comfortable with code reuse. Hidden test files may help to remind students that real programs are not intended to be run once on a single data file.

Some instructional suggestions of other researchers are right on the mark. More use of program reading and debugging in programming instruction would be appropriate (Pea, 1986). When teaching students to read programs, emphasize abstract comprehension of the whole procedure or program, not just line by line code comprehension (Hoadley, Linn, Mann, and Clancy, 1996). More emphasis on teaching semantic, schematic, and strategic knowledge, not just syntactic knowledge, would be appropriate (Mayer, 1988). Emphasizing the importance of concentrating on a program's data structures and processes rather than on its superficial form would also be appropriate (Boehm-Davis, Holt, and Schultz, 1992).

Linn and Clancy (1992) advocate the use of case studies of programming problems, thereby pushing decisions about program organization to the forefront. Classroom discussion of programming style is useful, but must be done with care because, as the interviews showed, through the eyes of some students writing an easy to modify program may imply using duplicate code. Using readability as a criterion on which to critique students' programs is appropriate (Joni and Soloway, 1986), but must be done with care because, as the interviews of this study showed, not all students consider the same programs to be readable.

Conclusion

Further research is necessary to determine the extent to which the student attitudes in this study are pervasive and to examine in more detail the reasons for the attitudes. Further research is also necessary to test and fine-tune the suggestions for instruction. With the increased popularity of the object-oriented programming paradigm, an appreciation of the benefits of code reuse is becoming even more critical. It would be particularly useful to monitor the attitudes toward code reuse of students learning object-oriented programming and to test the suggestions for instruction in that context.

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Appendix A: Reused and Duplicate Procedures

Reused Procedure

```
{Update summary information based on current keyboard entry.}
procedure Update (sale : real;                 {Amount of current sale}
                  var howmany : integer;       {Number of sales}
                  var sumsales : real;         {Total amount of sales}
                  var max : real);             {Largest sale}
begin
howmany := howmany + 1;
sumsales := sumsales + sale;
if sale > max then max := sale;
end; {Update}
```

Calling the Reused Procedure

```
if letter = 'A' then Update (sale, Ahowmany, Asum, Amax)
else if letter = 'B' then Update (sale, Bhowmany, Bsum, Bmax);
```

Duplicate Procedures

```
{Update A's summary information based on current keyboard entry.}
procedure AUpdate (sale : real;                {Amount of current sale}
                  var Ahowmany : integer;      {Number of sales}
                  var Asum : real;             {Total amount of sales}
                  var Amax : real);            {Largest sale}
begin
Ahowmany := Ahowmany + 1;
Asum := Asum + sale;
if sale > Amax then Amax := sale;
end; {AUpdate}

{Update B's summary information based on current keyboard entry.}
procedure BUpdate (sale : real;                {Amount of current sale}
                  var Bhowmany : integer;      {Number of sales}
                  var Bsum : real;             {Total amount of sales}
                  var Bmax : real);            {Largest sale}
{Body as in procedure AUpdate above, but using 'B' parameter names instead of 'A' names}
```

Calling The Duplicate Procedures

```
if letter = 'A' then AUpdate (sale, Ahowmany, Asum, Amax)
else if letter = 'B' then BUpdate (sale, Bhowmany, Bsum, Bmax);
```

Appendix B: Tally of Results

Comparison of Program With Duplicate Procedures to Program With Reused Procedure

	Number of Professionals					
	Interview 1			Interview 2		
	Better	Same	Worse	Better	Same	Worse
Ease of Reading	0	1	3	0	1	3
Ease of Debugging	0	0	4	0	0	4
Ease of Maintenance	0	0	4	0	1	3
Quality of Design	0	0	4	0	0	4

	Number of Students					
	Interview 1			Interview 2		
	Better	Same	Worse	Better	Same	Worse
Ease of Reading	14	5	4	6	12	5
Ease of Debugging	9	8	6	7	8	8
Ease of Maintenance	7	5	11	6	4	13
Quality of Design	7	4	12	4	2	17

General Session: Technology Implementation/Educational Reform

Scaling Up: Implementing Technology and Change in a Large District

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Key Words: **technology, library computers, change, resource-based, information skills, reading**

Over the past five years the Seattle School District, like most school districts across the country, has introduced thousands of computers into its 100 schools in the hope that technology would foment educational reform. In at least one area reform is occurring: the creation of a library computer system has been the catalyst that is changing the role of the library, and benefiting students, teachers and librarians.

Seattle voters approved a $22 million levy for instructional technology in 1991. Money was earmarked for only three district-wide projects. The largest amount, $3 million, was set aside for installation of an online system in each of 90 school libraries.

The team that allocated levy resources understood that a good school library:

- improves how much and how well students read,
- changes the ways in which teachers teach and students learn,

- enhances the ability of students to find and use information, and
- increases the amount of information available.

They saw that technology could play a role in transforming our libraries so that they not only could become "good" libraries, but the libraries would also become powerful tools that assisted the district in achieving its educational goals.

The process of preparing 90 libraries for computers helped each school staff to understand that the result would be a different library. Weeding collections, taking inventory, creating a database of MARC records and applying barcodes were expensive, time-consuming foundational tasks. They required the librarian, principal and teachers to align the library collection with the curriculum and with the reading and interest levels of the students.

Adding computers to a school library also required rearranging the physical space. Librarians and other teaching staff had to understand that a school library is a library classroom. Once they accepted that new model, then they had to make conscious decisions about where in that space certain teaching and learning activities should occur. Given the cost of wiring and remodeling, and the need to stay within budget, it was important for librarians to think twice, and wire once.

The timeline we devised allowed us to simultaneously work on long background projects, like weeding, inventory, conversion to electronic MARC records, space redesign and wiring and to focus on the most important element in the success of the project: staff development.

The key to transforming our libraries was to use the new technology tools to make the library part of a resource-based learning system. We not only wanted students to check out more books and relevant materials, but we wanted the library computers to help students acquire, analyze, and synthesize information and to publish their results. We wanted to use the library as a tool to make students more active learners.

Providing students with the ability to do keyword searches from a library workstation is a powerful tool in the effort to make students active learners. It puts more relevant information at their finger tips. When the library system is linked to the Internet the power of keyword searches grows geometrically. To ensure these tools were used effectively, we offered ongoing staff development that:

- Provided each librarian with a computer, and offered them numerous technology classes to ensure that they would be computer literate.
- Assigned one librarian to go to each library and work with librarians, to teach them how to use the library computer system.
- Offered large workshops during monthly librarian meetings, small classes, and individual tutoring. All of these efforts focused on giving librarians the technology skills and the instructional strategies they needed to use these new tools effectively.
- Created model libraries, so that everyone could see local examples of how libraries benefit students. These libraries modeled "best practices" found in the effective school libraries, and established target norms (like circulation) for all schools. And we created a video so that all librarians could see key aspects of these model libraries.

The act of scaling up to install 90 library computer systems caused administrators, teachers and librarians to ask fundamental questions about the purposes of a school library, and then translate those purposes into daily practice. We are changing the ways school libraries are used (resource-based teaching and learning), how much they are used (circulation), and providing access to a wider variety of resources (keyword searching, union catalog, CD-ROM and Internet). Each of these changes are proving beneficial to teachers and students. We are seeing that large scale, district wide technology projects can drive significant educational reform and improvement.

General Session: New Curriculum Designs/Instructional Strategies

Exploring Geometry by Using VRML to Build 3-D Worlds

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http://castle.uvic.ca/educ/lfrancis/web/timshome.html
http://castle.uvic.ca/educ/lfrancis/web/index

Key Words: **VRML, 3-D worlds, virtual reality, geometry, Internet**

Abstract

Virtual Reality Modeling Language (VRML, pronounced vermal) is a language for describing three-dimensional worlds that can be viewed on the computer. VRML 2.0 is a public standard that is followed to varying degrees by competing companies and institutions in order to facilitate the sharing of 3-D information across the Internet and across different computer platforms. The viewer is able to move within these virtual 3-D worlds by using specialized "browsers" which present animated sequences of 3-D renderings resulting in a truer 3-D effect than we have been accustomed to.

Virtual worlds are described using ASCII text files that contain VRML commands including references to other VRML files, links to other types of files (HTML etc.), and references to images. These files may be built from scratch (kind of like writing a postscript file) or with a VRML builder (a tool that does for 3-D what paint/draw programs do for 2-D). Although the "dummies" book on VRML suggests that "… you'd have to be an Einstein to create anything interesting" when building a VRML world using only a word processor, we disagree. There is a significant potential for teaching and learning visual literacy, computer programming, geometry (coordinate systems, perspective, polyhedra etc.), and trigonometry through the "hands-on" construction of virtual 3-D worlds. However, we would recommend the use of a spreadsheet for generating complex surfaces (vertex coordinates and face sets).

This session will explore the following:

1. Available VRML plug-ins, browsers and applications.
2. Techniques for navigating in 3-dimensional worlds.
3. VRML code and syntax.
4. The use of spreadsheets to generate data for complex surfaces.
5. Sample VRML worlds.
6. Connections to geometry, trigonometry, design, and computer programming in the classroom.

General Session: New Curriculum Designs/Instructional Strategies

The School Computer Lab: A Community of Resources

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Key Words: **computer labs, community service, community building, remedial education, connected learning community**

Abstract

Sheila dropped out of school in the tenth grade. She thought she was too dumb to learn. Now raising school-aged children of her own, she has rediscovered her appetite for education and has successfully completed three of five tests toward her Graduate Equivalency Degree. She credits a computer lab at her children's elementary school. The lab is open to the community after school until 8:30 p.m. four nights a week.

"The Hawthorne after-school program helped me challenge myself to go back to school to get my G.E.D.," says Sheila. "I really had a fear of education. I was on welfare for 17 years; I didn't think that I could ever do what I'm doing today. I didn't have the confidence."

Sheila discovered the after-school computer lab when three of her children were enrolled at Hawthorne. She took advantage of the program to build her own elementary reading and learning skills while her children worked on theirs beside her. Sheila and her family have since moved to another school district where she has registered with a vocational school to complete the course work necessary for her G.E.D.

"As I began to use some of the reading programs on the Hawthorne computers, I began to find that I could do some of them. I wasn't as dumb as I thought I was," says Sheila. "I conquered my fear. It gave me a love for education."

Building a Stronger Community

Jay Franco, who was in charge of the Hawthorne computer lab before moving to another school in Seattle recently, says the key to the success of Hawthorne's after-school program has been participation by the community at large from organizations like Powerful Schools and the Seattle Learning Alliance to individual computer professionals and parent volunteers.

"The computer lab has given Hawthorne a pride of accomplishment," says Bill Block, parent of three Hawthorne students. "As the community comes together and sees its members learning and sharing at the lab, you get that element of pride that is important to building a community.... It is a chance to make clear to everyone that the public schools are for more than just the children who are there. You get families who have a stake in the school. That builds the community around the school and helps both inside and outside."

The open computer lab is one of the most successful initiatives Hawthorne Elementary School has made in its effort to extend educational services and learning beyond the school day. Since 1993 over 500 community residents have regularly used the school's computers after school hours. Participants include elementary, middle school and high school students from more than 12 other public and private schools as well as home-schooled children, parents, and other adults. People of all ages come to use educational software programs that teach basic reading and math skills, word-processing, and desktop publishing. They come to learn typing, to complete homework assignments, to write resumes, to correspond using e-mail, and to explore the Internet.

"I think it has a lot to do with the computers, the programs that are on the computers, as well as the teacher and the atmosphere at the school," says Sheila. "It's a family environment. It helps us as parents get involved in teaching our kids that it's OK to learn. As they see us learning, that motivates them to learn."

Franco sees the community building effects first hand. He estimates attendance has grown 30–40% since new computers and software were donated by Microsoft. "Having Windows 95 running on new machines, all with access to the World Wide Web, has really increased participation," he says, observing that the after school program has started to attract adults who have no school-aged children and no other relationship with the school. "These people are very appreciative of this facility and this service. I think they would be far more likely, now, to vote in favor of a levy to support technology in the schools."

Another Hawthorne teacher, Patty Salerno, recently joined Franco to help staff the after-school program. "I felt it would be a good place for me to develop my own skills with a computer. I don't have any real technical aptitudes, but I find that I'm using computers very successfully with my students in the classroom with writing and math especially."

As a teacher, Salerno admits that learning about computers had been somewhat intimidating. "The technology is moving so fast that teachers feel confused about the most effective way to use it," but she says she's found that her experience in the after-school computer lab has made her "more sensitive to people and their learning processes. We're all learning together. I'm starting to understand the big picture of how important it is for everybody to have the opportunity to share this experience."

Salerno has been sharing her computer experience with three other adults who visit the Hawthorne lab regularly. "They're grandmothers and they're really excited about what they're learning," says Salerno. "They come with their grandchildren. In the workplace, they've seen others use computers to access different Internet sites around the world, and they want their grandchildren to be exposed to this. It's an important resource that they can't give their children at home." Franco says Hawthorne students make up 80–85% of total attendance. "We usually have all 27 computers filled for the first hour after school. Many days we don't have enough computers to go around. There are a few adults and some older siblings who come in to meet these kids and work together with them. After five o'clock, older siblings and adults come in to work on their own projects."

Franco says that interest in the Internet has drawn an increasing number of adults into the computer lab. "It has the most potential for making the school an information and learning center for the whole community," he says. "There really is no other place where many people can go to learn how to access the Internet."

On a recent evening, just as Franco was closing down the lab and preparing to lock up, a high school student stopped in looking for help with a current-events paper. She asked Franco how to find information about the conflict in Bosnia. He introduced the girl to the World Wide Web. Within 10 minutes, he says, a search for the word "Bosnia" turned up extensive information from several sites including a comprehensive history of the conflict as well as the complete text of the most recent peace treaty.

"We printed out over 35 pages of information, and she had a grin on her face like she'd hit the jackpot," says Franco. "You think about those kids that have this in their homes and know how to use it. They have a tremendous advantage. We just have to make it available to everybody."

Reaching a Diverse Population

Reaching A Diverse Population Hawthorne Elementary serves a diverse urban population: roughly 35% of the students are white, 35% are African American, and 25% are Asian. The remainder includes Latino and Native American children. English is a second language for about one of every five students, and about half of the school's approximately 500 children qualify for free or reduced price lunches. Most of these students would not have access to computer technology were it not for the school's community computer lab.

"Many of these kids qualify for remedial help with math or reading. Some get additional help with special education or English as a second language," says Franco, who has developed a broad based library of educational software titles through the years. "In many cases the parents need help too. We want to encourage parent participation."

Franco's after-school program started in 1993 thanks in large measure to Powerful Schools, a local non-profit organization of parents, business people, and school staff from four neighboring public schools. Initial grant funding solicited by Powerful Schools allowed Hawthorne to keep its computer lab open for one evening a week.

"It had always been my hunch that the community would value this resource and the services and opportunities that we offer," says Franco. "The response has been greater than my original expectations." Every night it seemed there was a new story to tell.

Franco recalls a Vietnamese father who came in to see his first grade daughter work on her math and reading skills. He decided to work on his own spelling at the same time. "She would come over and sit on his lap to work the spelling program with him, then she'd go back to her computer and he'd look in on her to see what she was doing. He eventually added reading vocabulary and comprehension to his menu of activities in the lab."

Seattle school board president Linda Harris was impressed with Franco's initiative and was able to facilitate additional funding to extend the program to four nights a week through the end of the school year. Harris believes parental involvement is a critical factor in academic performance.

"What we see nationally and statewide is the cutback on funding for dealing with social issues in education. The thrust of much current legislation assumes that kids come to school ready to learn. It's the school's job only to educate them, not to deal with social problems. But that doesn't mean that the social problems are going to go away."

Faced with that dilemma, Harris believes "you've got to have this type of partnership with the community to help make schools work. We're just going to have to have more people involved at their neighborhood schools." Harris believes programs like Franco's at Hawthorne demonstrate how involving the broader community in their neighborhood schools benefits everyone.

"When we first opened up, we had quite a few parents that came in to work next to their children and to learn about computers for themselves," says Franco. "I realized that we didn't have enough software for the adults. So the second year I was able to get a grant for an adult education software package—adult literacy, G.E.D. preparation, life skills, job skills and resume preparation."

Help From Business

Hawthorne's after-school computer lab also began to attract the attention of the region's computer software industry. A grant from the Washington Software Association in addition to funding from the Seattle Learning Alliance allowed the lab to reopen for four nights a week in the following school year. In addition, Franco's computer lab began to receive in-kind donations of software and computer services from interested professionals at local software companies including Microsoft and Edmark.

In the spring of 1995, Brigadoon, a communications network provider gave Hawthorne free access to the Internet. "On those nights that we offered an Internet class, the room was packed," says Franco. "Close to 20 people each night, and many of those people did not have kids in the school, they were just community residents... now they have a new reason to come to school." Brigadoon has provided Hawthorne students and staff with free Internet e-mail and graphical World Wide Web access. Brigadoon is working with Hawthorne to deliver Internet access and publishing capabilities at low cost for the rest of the community while at the same time generating enough revenue for the school to defray the costs of new technology for the classroom.

This year, Microsoft has provided additional multimedia workstations and software, as well as funds for staffing the Hawthorne lab after school. "The kids love to use the Microsoft CD-ROM programs as well as Creative Writer and Fine Artist desktop publishing programs. Programs like Encarta, Musical Instruments, Explorapedia, and Magic School Bus are very popular," says Franco. "I believe that this technology has the hooks to bring people into the schools for educational services and training as well as access to information via the Internet."

Microsoft's grant to Hawthorne's community lab is part of that company's continuing initiative to help build a global "Connected Learning Community" in which all students, educators and parents have access to technology and skills to use information more effectively.

"Right now they say 11% of American households have a computer and access to the Internet, so what about the rest of them?" asks Franco. "Having technology in the home creates a huge advantage, even just for word processing. Then there are people who have a CD-ROM drive. Then there are people who have Internet access. Kids who have those kinds of resources and experiences have a very clear advantage when it comes time to compete for higher education or for work."

"Clearly, we have to provide those kinds of opportunities for kids, and not just the kids in Hawthorne Elementary School, but older kids in the community, and adults too. I think everyone has a desire to use computers. Unfortunately there are many who do not have any kind of access to them other than at school."

Seattle school board president Linda Harris agrees. "Today computing technology is like a textbook or a pencil. It's a basic tool regardless of what job you may want to pursue. Technology is going to be a part of everybody's life. We need to make those kinds of tools available."

"Right now we're just trying to make sure that students have access and the time to get their hands on the equipment," Harris continues. "By opening that school up in the evenings for the entire community, you're opening access to many people who probably wouldn't be able to afford a computer in their homes. You're leveling the playing field."

Current/Emerging Technologies

Accessible Web Design

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Key Words: **universal access design, accessible Web design, World Wide Web, disabled users**

The World Wide Web has rapidly become the most popular Internet resource, combining hypertext and multimedia to provide a huge network of educational, governmental and commercial resources. Yet many Internet surfers cannot access some of these materials. Some visitors

- cannot see graphics because of visual impairments.
- cannot hear audio because of hearing impairments.
- use slow connections and modems which cannot download large files.
- have difficulty when screens are unorganized, inconsistent and cluttered and when descriptions and instructions are unclear. These difficulties may occur because they have learning disabilities, speak English as a second language, or are younger than the average user.
- use adaptive technology with their computer to access the Web.

Following universal access design principles ensures that all Internet users can get to the information at your Web site regardless of their disability or the limitations of their equipment and software.

General Page Design

Maintain a simple, consistent page layout throughout your site.

A consistent design and look makes it easier for visitors to navigate through the hypertext and find the information you want to provide. For example, features presented on every page, such as a standard navigation menu or logo for the site, should always appear in the same place. A carefully planned organizational scheme will help everyone use your site. A clear, consistent presentation will especially assist people with learning disabilities who have difficulty following disorganized presentations.

Keep backgrounds simple. Make sure there is enough contrast.

People with low vision or colorblindness, or those using black and white monitors can have difficulty reading information at sites with busy backgrounds and dark colors. Many background images and colors obscure text and make reading difficult. Make sure that there is enough contrast between your text and the background of the page. Choose background, text and link colors carefully, and always test your site with both black and white and color monitors.

Use standard HTML.

HTML was designed to be a universal format outside the bounds of proprietary software and computer languages. While non-standard tags exist, using standard HTML tags will ensure that your content can be accessed by all browsers used by visitors to your site. Avoid tags, such as <BLINK>, that are not supported by all Web browsers.

Include a note about accessibility.

Notify your users that you are concerned about accessibility by including a Web access symbol on your page. Encourage your users to notify you with their accessibility concerns. Include a statement about accessibility.

Graphical Features

People who are blind cannot view the graphical features of your Web site. Many people with visual impairments use voice output programs with text-based browsers (such as Lynx) or graphical browsers with the feature that loads images turned off. Include text alternatives to make the content in these graphical features accessible. Here are guidelines for providing alternative text for various types of visual features.

Include short, descriptive ALT tags for all graphical features on your page.

The ALT tag is an HTML tag that is used to give alternative text information for graphical features. The alternative text helps the visitor understand what is on the page if they are using a text browser or if they have image loading turned off in their graphical browser. ALT tags should be short and simple (less than 5 words) as browsers sometimes have difficulty with long, run-on ALT tags. The bolded text below shows what an ALT tag looks like in HTML:

```
<IMG SRC="./doitlogo.large.gif" ALIGN=MIDDLE ALT="[DO-IT LOGO]">
```

Include menu alternatives for image maps to ensure that the embedded links are accessible.

A site that uses an image map for navigation, but does not also have an alternative navigation menu, can block visitors using text-based browsers.

Include descriptive captions for pictures and transcriptions of manuscript images.

What information do your pictures and images provide to the viewer? Always provide an ALT tag for an image. This is sufficient for logos and graphics that are not critical to the information content of the page. But if the graphics provide information beyond this, adding captions and transcriptions is important for those who cannot see your page because they are using a text-based browser, including those who are blind.

Caption video and transcribe other audio.

Multimedia and audio formats can present barriers to people with hearing and visual impairments as well as for people with less sophisticated computer systems. Provide captioning and transcriptions for materials in these mediums so that these visitors to your page have an alternative method of accessing this information.

Special Features

Use tables and frames sparingly and consider alternatives.

Most screen reader programs read from left to right, jumbling the meaning of information in tables. Some adaptive technology will be refined to deal with graphical issues such as this, but at this point, look for other ways to present the information so that visitors with visual impairments can reach your data. In the same vein, frames often present logistical nightmares to text-based screen reading software. Evaluate whether frames are truly necessary at your site.

Forms and databases.

Always test forms and databases with a text-based browser. Include an e-mail address and other contact information for those who cannot use your forms or database.

Applets and plug-ins.

As the software is developed, applets (such as programs created with JAVA) and plug-ins (such as Adobe Acrobat) may provide accessibility features. However, many of these programs are currently not accessible to people utilizing text-based browsers. To ensure that people with vision and hearing impairments can access your information, provide the content from these programs in other, text-based formats.

Web Pages Test

Test your Web page with as many Web browsers as you can, and always test your Web page with at least one text-based browser. This way, you will see your Web resources from the many perspectives of your users. You may want to try out an accessibility validation site which performs a diagnostic on your pages and points out parts that could be inaccessible.

Testing your site is especially important if you use HTML editor software to write your pages. Some HTML editor programs do not automatically include ALT tags and other accessibility features. You may need to revise your code to include the accessibility guidelines covered in this brochure.

General Session: Current/Emerging Technologies

Web Caching Server: Essential, Affordable, Powerful Tool for Networks

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Key Words: **caching, server, UNIX, LAN, World Wide Web**

Brief Description

A Web Caching Server decreases latency on broad and narrow bandwidth LANs accessing the World Wide Web by storing previously accessed pages in a centralized cache.

A caching server is a powerful addition to any local area network. Currently, the most common operating system is UNIX running on a Pentium CPU. We have implemented LINUX, a public domain version of UNIX. Currently, we are maintaining caching servers in two high schools and four elementary schools in Albuquerque Public Schools.

Each time a student or teacher (or other user) accesses a page on the Web, the caching server checks to see if it already has the most recent version of the page. If it does, the page is dished up to the user at Ethernet speed. This is very useful in scenarios like these:

- A teacher has asked her class to find out information about a particular subject and all students are researching similar—often the same—sites. Instead of waiting while each one downloads the same page, each student gets her document immediately.
- A teacher is working on media literacy with his class. He would like the students to study the same handful of pages and critique them. Again, latency is greatly decreased. The bandwidth is saved for students watching NASA video.

In development is a useful new application which will be invaluable to schools whose access is interrupted because their Internet service is down. If the server determines that service is interrupted, it allows users to access the current pages in the cache.

The server is also a good place for students to develop and publish Web pages. Large hard drives are inexpensive. Again, it is convenient to have students doing their work at Ethernet speed. No matter how much bandwidth a school has, the data line is always the bottleneck.

The e-mail package Pine ships with LINUX. Pine is a sturdy, text-based mail server which can support schools with large or small populations. Pine is used in many UNIX-based settings like colleges and universities. The caching server can be the school mail server.

Access service is available with a caching server. When school closes for the day, the phones can be switched to modems to access the server from home.

The LINUX operating system also supports DNS (Domain Name Service).

Finally, caching can be extended in a wide area network. At a particular time of day or night, the servers can poll each other and update themselves so everyone has the most recent versions of what everyone else has accessed.

General Session: New Curriculum Designs/Instructional Strategies

Exemplary Telecommunications Projects: Winners of the 1996 SIG/Tel Contest

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Key Words: **telecommunications, poster session, SIG/Tel**

Each year SIG/Tel, a special interest group of ISTE, invites teachers of students of any age to share their successful telecommunications projects. Winners receive recognition at Tel•Ed and NECC, as well as a variety of prizes including online subscriptions, modems, and software. Their work is published in TIE, the SIG/Tel journal. Copies of TIE will be available at NECC in the ISTE booth in the Vendor area and at this workshop.

Set up like a poster session, winners of 1996 Contest will share their work with you. Winners will be prepared to answer questions about logistics, curriculum relevance, and why the project worked. They will be interested in hearing from you, too, about your telecommunications interests.

Please join members of the SIG/Tel Board and contest participants at this informal and informative sharing session. Find out how you can submit your student work for the 1997 Contest.

General Session: Improved Productivity/Administration

Providing Support for Technology Coordinators (and Others) Via the Web

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Key Words: **technology coordinator, technology support, Web page, staff development, networking issues**

Learn how a large school district provides valuable technology support resources using the "Lincoln Public Schools Instructional Technology Web." Computer teachers and coordinators from over 50 buildings in this district use these pages to find:

- Answers to FAQs on software used by the district
- Trouble-shooting aids for computer management and maintenance
- A first line of defense for solving network problems
- Calendar schedules for district technology training and meetings
- Supported Internet software and documentation, all downloadable
- Downloadable training guides
- Purchasing information for computers and related peripherals and supplies
- Any district licensed software, downloadable by password
- An online monthly newsletter with timely topics
- Up-to-the-minute tips and tricks in the "What's new" section
- Links to other helpful sites

The presenters will not only share this site, but also share how the process for building the site developed.

http://www.esu18.k12.ne.us/instruction/curr/insttech

General Session: Current/Emerging Technologies

Designing Virtual Practicums for Preservice Teachers: Three Project Iterations

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Key Words: **student teaching, telecommunication skills, distance learning, online activities, technology integration**

Abstract

This paper reviews the development of four Virtual Practicums for preservice teachers over a 12 month period. The first iteration of the project involved matching more than 20 preservice teachers at Massey University (Palmerston North, New Zealand) with 40 students drawn from the Nechako Electronic Busing Program and Sinkutview Elementary School (Vanderhoof, B.C.).

This electronic project was delivered over a period of six weeks. A second pilot project explored the potential of Virtual Practicums connecting preservice teachers from the University of Calgary with Online Teachers from the Nechako Electronic Busing Program for a six week online teaching/learning experience with E-Bus families. Recommendations arising from this experience were incorporated into a full practicum project offered during the 1997 winter term, connecting student teachers at the University of Calgary with Online teachers from the Nechako Electronic Busing Program. A fourth project was conducted in the Spring of 1997 that involved 24 student teachers from Massey University and six Online Teachers.

Literature Review

While there is a growing research base that supports the notion of providing technology training for preservice teachers (Levin, 1995, Duckett, 1995, McClintock, 1994, Maddux, Johnson, and Harlow, 1994, Kester and Beacham, 1994), and also a growing body of research that describes some of the necessary features of online learning environments (Hiltz, 1995), there is almost no research that describes how preservice teachers might acquire the skills necessary to create, foster and evaluate online learning activities for direct use with students.

Levin, Waugh, Clift, and Brown's (1995) Teleapprenticeship Model developed at University of Illinois, looks at support systems for preservice and beginning teachers. His model does not look at using technology to develop online teaching skills or to assist in the design, delivery and support of computer mediated learning activities.

The models developed by Makurat, (1994), Gunn, (1994) Kester, and Beacham, (1994) look at teaching preservice teachers how to use electronic mail and then try to extend these skills into collaborative learning activities. These models and projects do not explore the skills, knowledge and attitudes important in preparing teachers to use telecommunication technologies to actually teach distant students. This project is an attempt to gather that information.

Project One: Massey University Students

The purpose of the project was to explore the skills needed to develop, deliver and support educational activities electronically to elementary students and to provide opportunities to integrate technical skills into teaching practice. The student teacher pairs created 3–6 learning activities to achieve stated learning outcomes supported by Internet resources and delivered these via electronic mail over a 3–4 week period. Learning how to use electronic mail and Internet tool skills were vital.

Data

Messages between all parties were collected and archived. Transcripts totaled approximately 135 pages. Student teachers were also asked to record comments, observations, and insights weekly in a reflective electronic journal. Message and journal texts were examined for the emergence of factors and themes significant to participants.

Identified Themes and Discussion

1. Significant Organizational Factors included:
    - Roles and responsibilities
    - Clarifying expectations
    - Establishing timelines
    - Assumptions/cultural backgrounds and differences.

Future projects could be improved by sharing class schedules, assignment dates, and holiday times. Clarifying expectations about the amount of electronic communication necessary during the start-up period between student teacher pairs and the facilitator would also be helpful.

Creating an archive of projects to which new student teacher pairs can refer will be extremely useful in future efforts.

2. Management Factors included:
    - Managing volume of communications
    - Updates—keeping all parties in the picture
    - Adjusting to change; making modifications.

In retrospect, handling 10 groups of communicating partners amounted to more traffic than should have been attempted in an exploratory project. Reducing the number of groups or sharing the mentorship task would reduce this load. Involving classroom teachers in providing feedback directly to student teachers in the planning stage would be very helpful.

3. Project Factors: Planning, Preparation, Delivering, Supporting and Evaluating
    - Partner selection and group process
    - Topic selection
    - Identifying resources
    - Setting goals/learning outcomes
    - Background knowledge
    - Time
    - Instructions and referencing resources
    - Expectations for students and student work
    - Feedback

Project activities need to be blended into an integrated series of steps towards a specific goal; these steps need to reflect more clearly the important aspects of good pedagogy. The provision of superior Internet resources to support projects is very important. Unfortunately groups who provided an insufficient number of supporting resources, or used inappropriate resources for the specific task had real problems with the completion rate of tasks or lessons. The task of locating resources cannot be passed on to the students unless adequate guided practice is provided first.

Formatting of messages needs to become much more important. Being able to draw the student's attention to important information within a text based medium is an art form. The biggest formatting error was to include too much text in each message. Students need instructions broken into manageable chunks—perhaps outlining what can be accomplished in one 30 minute session. Consistency in referring to activities as lessons, or tasks was also helpful, but a feature that many groups overlooked. Preservice teachers with a higher degree of Internet literacy might be able to take advantage of posting materials on the Internet.

Feedback and how it is provided to students is also important. Personal messages from both partners making specific references to earlier communications were valued by the participating students and their parents. Both students and parents requested that answers be provided so that self checking could occur. Evaluation of student work requires further exploration.

Student teacher partners working with students from elementary classrooms, experienced different problems than those working with students from the Electronic Busing Program. Students in classroom settings operated in a largely independent context where there were competing demands on their time and energy, assistance was not always readily available, and access to computer networks and Internet resources needed to be shared. Students from the E-Bus program had more guidance and supervision from parents at all times, and were able to concentrate their energies on completing the task at hand.

4. Communication Factors:
    - Learning to use electronic mail/e-mail etiquette
    - Security
    - Frustration at amount of feedback provided by students

This collaboration hinged on the ability of the student teacher pairs to use electronic mail as their fundamental communication tool. Quick and effective communication was particularly crucial at the beginning of the project when the greatest number of concerns arose.

The early pattern of once a week communication was not sufficient to support the kind of collaboration required to get all of the groups off to a productive start. The initial lag on message turnaround was a significant factor in successful completion. As the project progressed, the number of contacts per group per week increased and this allowed for more efficient feedback and problem solving.

It was very important that expectations surrounding the frequency, and the format for messages be established early in the process. More time needed to be devoted to the less formal exchanges of information that occurred at the beginning when curiosity was high. The immediacy of communication between parties was what excited and captured the interest of elementary students. Teaching all parties to check their mail regularly and to respond to each new messages was an extremely important task.

Many of the elementary students had minimal keyboarding skills, thus responding to information requests took time away from completing the "job." Students tended to respond with generalities instead of specific information, and time lags between receiving the request and answering it varied according to other pressures in the classroom. If students come to expect new "mail" each time they check, then they will quickly learn that checking is important. If they receive quick answers to their questions, then asking for clarification via e-mail becomes an option for them. When no communication occurs the parties involved assumed that no work was being done. This was often incorrect. Students were so busy "working" they didn't have time for e-mail (which was not seen as part of the work)! Student teacher pairs should communicate in the future directly with classroom teachers who can provide valuable feedback that the children are unable to articulate.

This project was a very time consuming undertaking requiring many more hours of preparation than the average classroom lesson. Student teachers simply ran out of time. Students who could tolerate high levels of ambiguity, decided to proceed with a course of action that could be modified as needed. Others, faced with indecision, had difficulty completing the project. It is important to recognize that in addition to this undertaking, Massey University students were involved in many other class activities that demanded their time and attention.

6. Technical
    - Hardware/software
    - Access to lab facilitates
    - Basic computer literacy
    - Learning/applying skills simultaneously.

If this kind of project is used as a vehicle for teaching preservice teachers how to use electronic mail and Internet tools in educational practice, two distinct phases should occur. In the first phase, student teachers acquire and practice the skills needed; in the second phase, they can concentrate on applying the skills to the task of creating, delivering and supporting online activities. If additional access to lab facilities cannot be provided, then groups will need to organise themselves to make sure that regular e-mail contact is maintained with students, and with the facilitator.

Recommendations

1. Require that participating student teachers have basic skills in using electronic mail and Internet tools OR develop the project in two stages.
    - Stage One would focus on learning how to use e-mail and Internet tools.
    - Stage Two would explore how these can be used to support electronic learning activities and collaborative exchanges between partners.
2. Share complete time table information in advance so that timelines are more appropriate.
3. Create a complete archive of papers, and projects from this year's participating student teachers to be provided to the next group of student teachers.
4. Limit the number of groups participating in the project, or share mentorship tasks.
5. Involve classroom teachers and parents in the planning of projects and in providing feedback and mentoring.
6. Emphasize the connections between good pedagogical practice in a classroom and good pedagogical practice in preparing learning activities for electronic delivery.
7. Pay special attention to resources provided to support activities, and to how activities are formatted for use with elementary students.
8. Increase the volume, frequency and quick response of communications between participants at all levels.
9. Concentrate on creating an electronic communication "process" which articulates the expectations with students. Invest time in the initial stages of the project establishing with students what good electronic communications look like and what kinds of information must be shared.

Project Two: Calgary Students

Two student teachers from the University of Calgary were paired with teachers from the Nechako Electronic Busing Program in May 1996. The first tasks of these students were to set up the computer, become familiar with the software, arrange for Internet connections, and to prepare an electronic letter of introduction to forward to all clientele. These letters were then electronically circulated to parents. At the same time, e-mail correspondences were begun between the student teachers and the cooperating teachers to establish a rapport and a common understanding of the practicum.

Several tasks were required of the student teachers over this short, six week practicum. Initially, Internet searches were conducted to identify resources that could be utilized in a variety of instructional settings. The student teachers then constructed discrete units of study that employed some of the strengths of electronic communication. These units evolved through several iterations in order to have them not resemble correspondence courses with a directive teacher approach.

The intent at this point was to have volunteer E-Bus families work with the student teachers to implement the unit and then offer feedback on its effectiveness. Due to time limitations and the fact that many families were winding up their academic activities for the year, the student teachers did not have an opportunity to completely implement their work. Evaluations of the process proved to be quite positive student teacher or parents? Initial responsive journal entries focused on the paradigm shift required for online work, and later moved to a more comprehensive discussion of the trials and benefits of the process.

Project Three: University of Calgary Students

Another Virtual Practicum Project was proposed for the Winter 1997 semester at the University of Calgary that followed the model of delivering curricular support online. Student teacher tasks included clarification of B.C. Learning Outcomes for parents, identifying Internet resources to meet learning outcomes, writing tutorials of pedagogical techniques, the development of online projects for specific groups of students and expansion of the e-bus.com Web page.

Student teachers explored the Internet as a source of online professional development to challenge their own thinking about teaching and to encourage them to develop new ideas and skills. Other responsibilities included communicating and negotiating with parents on when, what and how to assess student growth and report this information. The student teachers developed an extensive Demonstration Project that drew on the strengths and interactivity of the Internet.

Ongoing expectations for student teachers participating in the Winter 1997 virtual practicum included:

- occasional scheduled meetings online
- entries in a reflective journal
- participation in an educational listserv.
- correspondence between student teachers and volunteer E-Bus families

A number of specific projects were completed over the 13 week practicum:

- development of a personal Web and resource page
- development of sample activities that integrated a resource identified by the student teachers into curriculum (learning outcomes)
- collection of Internet resources to support a specific theme, topic or cluster of learning outcomes with very general descriptions of how they might be used
- development of a final project involving the student teachers in planning, delivering, managing, and assessing student learning for the project they design. In this instance, the student teachers designed the prototype of a Web-based simulation.

Project Four: Massey University Students

At the time of writing, the concept for the practicum are in place, participants have been recruited and final details are being articulated. The discussion of the this project iteration will occur at the NECC '97 Conference in Seattle, WA.

Conclusion

Drawing on the experiences of the previous virtual practicums, several prerequisite skills have now been identified as well as a profile of a student teacher who would benefit from such an experience. Prerequisites skills tend to focus on tools skills, electronic resource and communication skills and pedagogical skills. Tool skills include a basic computer literacy and comfort with at least one operating system and a knowledge of basic applications such as word processing. Electronic communication prerequisite skills that would benefit a student teacher in a virtual practicum include a knowledge of e-mail and the ability to search the World Wide Web. Students with a wide range of teaching and subject experience will find the practicum experience more rewarding and gratifying considering the diversified nature of the clientele; specialists might not get the opportunity to draw upon their particular area of expertise.

Further, successful participants in previous virtual practicums demonstrated a willingness to be a problem solver, the ability to tolerate change and ambiguity, a degree of creativity and flexibility and the willingness to relinquish instructional control to parents and value them as full partners.

The format for the Winter 1997 practicum and the Virtual Practicum Project in general has enormous potential as a vehicle for accomplishing a series of diverse aims within any teacher preparation program. It provides a meaningful reason for learning Internet skills and offers an application of these skills into classroom settings. Student teachers are also encouraged to integrate curriculum across traditional subject and age boundaries as they integrate technology into practice. Opportunities to connect preservice teachers with experienced classroom teachers for a mutually beneficial experience can be provided. Such collaborations have enormous potential not only to further our knowledge of the processes and skills involved in online teaching, but also in providing an application of technology skills into successful teaching practice.

Acknowledgments

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General Session: Current/Emerging Technologies

Sony Electronics Distance Learning and WebTV

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Key Words: **distance learning, Sony, WebTV, education, Internet, classroom, World Wide Web**

Sony Distance Learning—The Whole World Within Your Reach

Sony Electronics Inc. is a leading manufacturer and supplier of broadcast, professional, and consumer audio, video and telecommunications equipment. Sony's U.S. operations are the result of a 32-year commitment to succeeding as an American Company.

Sony Electronics Distance Learning is collaborating with telecom providers, telecom hardware vendors, audio/video hardware vendors, software companies, computer companies, school-district-statewide education officials, local educators, state officials, and a host of other interested parties to install large, high performance distance learning networks.

Today, Distance Learning means a variety of strikingly different things to different people. The spectrum of definitions is quite broad, ranging from basic Internet capability, to talk show format educational television. Other Distance Learning requirements range from one way video/two way audio conferencing, to low bandwidth videoconferencing, or to full multimedia classrooms where high resolution video and audio exchanged real-time with multiple remote sites.

Iowa and Indiana are two pioneering states that have already implemented advanced Sony Classroom systems on a wide scale throughout the state. Iowa is closing in on the 400 classroom level. Indiana has targeted to grow to more than a 500 school network over the next 4 years and has made a very aggressive start over the past two years. In Iowa, there almost 100 sessions are held daily using the network with the capability to link over 100 distant sites simultaneously—although the norm is more in the three to four range. In Indiana as well as Iowa, community meetings, public health presentations, symphony broadcasts, trips backstage at the college theater department and the major city zoo, happen regularly.

Now, Ohio, Wisconsin and several other Midwestern states are implementing broad state networks. Texas has made a long term commitment to a distant learning network but looks as it will be pursuing the Internet enabled version of distance learning first. These Midwestern statewide networks have chosen to integrate their offerings with outside enrichment programs tying in the arts and science resources of local and distant sites of excellence.

Sony's WebTV—A Distance Learning Tool

Sony's WebTV Internet Terminal brings e-mail and the Internet into the Classroom—without the use of a computer. With the Sony Internet Terminal connected to any TV and a standard analog telephone line, students, teachers and administrators can discover the exciting world of electronic information and education. Sony's new WebTV product will allow students to communicate world-wide via e-mail and visit the many sites on the Internet. Learning from the wealth of Educational sites on the Web today, at a low monthly subscription cost, can help tie many schools together as we all enter the 21st century.

Sony supplies the Internet Terminal that makes your 33.6 Kbps hook up quick and easy and WebTV™ Networks is your total Internet provider for a low monthly fee. With easy-to-understand WebTV graphics menus on your TV screen, students and teachers can use the supplied Internet Commander remote control or the optional wireless Keyboard to point and click the Internet Sites you want. This light-weight portable terminal is also perfect for home use and for students to "check out" from school and take home for special assignments.

Teachers use the Sony WebTV terminal to enhance their lesson plans with topical and current news found on the Web. School libraries are able to use our WebTV terminals as "stand-alone" research stations to supplement their many library titles. Sony's WebTV box will also work with your TV's Picture in Picture function to allow students to view live TV broadcasted news while bringing up related headlines and articles from Internet sites (i.e. CNN.com) in the inset picture. Also, the built-in Surfwatch™ feature can allow Teachers and Administrators to limit or block student access to mature or inappropriate content. The Sony WebTV box has a list price of $399.99 and the optional keyboard is available at a list price of $99.95.

Sony Electronics, Inc. is committed, with its audio/video products and integration services, and is striving for the most important goals of Distance Learning; the integration of technology into the classroom, and to enhance what already works well, and to assure our students the best shot at success in the 21st Century.

Workshop

"Repurposing" Cable Resources in the Digital Classroom

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Key Words: **repurposing, cable resources, Cable in the Classroom initiative, cable TV**

Repurposing Cable in the Classroom Resources in the Digital Classroom is a workshop designed to help teachers begin to extend and enhance resources such as television programming from the Cable in the Classroom initiative, the Internet, CD-ROM, audio files and other technologies into the curriculum. The workshop will have teachers digitizing sounds, images, QuickTime and AVI movies from copyright cleared Cable in the Classroom video library with PowerPoint 97.

What Is the Cable in the Classroom Initiative?

The Cable in the Classroom initiative is a public service of the cable television industry. It is a joint project of local cable operators and national cable programmers who provide schools with free basic cable services and more than 540 hours of commercial-free educational television programming each month.

Teachers nationally can use the service without any viewing requirements. Educators can decide which programs to record from the air, when and how to use them. Copyright clearance acquired by the programmers allow teachers to have their students repurpose the resources while utilizing multimedia programs in the classroom.

The initiative provides schools with a publication named Cable in the Classroom with detailed listings of educational programming, sorted by subject area, plus information on copyright clearance, support materials, videotapes available for purchase, and more. Today, the same information provided in the magazine format is made available via the Internet (URL address: http://www.ciconline.com) with pertinent information about how to optimize cable resource in the classroom, in the school library and across the curriculum. Another bit of information for teachers with regards to The Cable in the Classroom programming is that it is commercial-free.

Schools today do not make use of the many free resources available to them. Participants to the workshop will acquire knowledge base and hands-on experience repurposing analog TV programming with the digital computer found in their classrooms. They will create multimedia presentations while combining other resources available to them during the workshop such as: Encarta 97 in CD-ROM format, Internet resources in the form of data, text, audio, and graphics.

What Is Multimedia?

Multimedia is about creating and constructing activities that possess unique value in an educational setting. Multimedia is not a new concept; in simple terms it means the use of computer technology to seamlessly integrate text, movies, pictures, animation and sound.

Multimedia refers to information delivered in multiple formats. For example, a student multimedia presentation about DNA could include video footage in the form of an AVI or QuickTime files from The Discovery Channel, Assignment Discovery; combining sounds from a musical audio CD to enhance a particular point in the presentation; textual information from the Internet in order to make a special point; and graphics from Encarta 97 to finish the presentation while making a visual statement.

General Session: New Curriculum Designs/Instructional Strategies

The Teen Aware Project: Using Technology to Develop Media Campaigns Promoting Teen Pregnancy Prevention

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Key Words: **teen pregnancy, community involvement, teen awareness**

Learn how a team of Bremerton High School teachers and students from visual communications, stage technology, drama, health and TV productions classes created a live multimedia performance to support teenage sexual abstinence as a part of Washington state's **Teen Aware Project**. A multimedia performance will be explored as a means of supporting interdisciplinary learning, media literacy, and the development of multiple intelligences.

Teen Aware Project Overview

Brainstorming and Getting Started

- How to get the process underway
- Creative brainstorming of possibilities
- Selecting multimedia topics
- Computer hardware and software considerations
- Presentation options
- Organizing student/staff teams
- Matching messages to technologies and audiences

Pitfalls and Successes

- Things that go wrong
- Things that go right
- The need for leadership structure
- How synergy effects project
- The importance of community involvement and support

General Session: Society Session/New Organizational Structures (Organized by ACM SIGCUE)

Systemic Thinking, Exploration, and Planning for an Educational Revolution

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Key Words: **systemic change, student achievement, partnerships, staff development, productivity, refom**

The Metropolitan School District of Wayne Township developed a technology strategy that evolved into a systemic initiative that is stimulating organizational change. Wayne Township is an urban school district of 13,000 students educated in 10 elementary schools, three junior high schools and one high school. Student needs are also met in junior and senior high alternative schools and regional special education and vocational cooperative schools. The schools' free and reduced lunch rate varies from 14% at the high school to 62% at one of the elementaries. The

district's location adjacent to the Indianapolis International Airport provides a substantial industrial base.

The district began to examine the connectivity of district processes, information systems, staff development delivery, and technical support to enable greater productivity and enhance student achievement. A planning consultant worked with district and community representatives in 1993 to develop a framework for implementing technology. An Office of Information Systems was developed to provide leadership and support. Each school is supported by a Technology Assistant who provides the first line of technical support. Technology Lead Teachers in each school serve as facilitators for the curriculum integration of technology and software. The vision of "the best we can be" unfolded to include a pervasive look of the district at-large. The expanded systemic initiative embraces the entire operational functioning of our school corporation.

The classroom is transformed with energized students actively involved in collaboration, problem solving, the writing process, and inquiry. Students are empowered to chart their own course of learning through the use of flexible software, access to information and supportive teachers who are assuming new roles. An emphasis is placed on classroom integration of technologies. Teachers become coaches, learners, encouragers, facilitators, and collaborators. Assessment tools provide accountability and immediate feedback on student achievement. This allows teachers to customize instruction for individual students.

Libraries are transformed into media centers which are the information hubs of the schools. Media centers incorporate student-centered multimedia production and research centers. The automation of media resources enables an enriched and immediate access to information. The union card catalog multiplies district resources available to students. Internet access provides current and real-time global information. Our students and staff access and communicate ideas through media services, enabling research, exploration and discovery.

School board retreats, community dialogues, site visits, study groups, and electronic roundtable discussions are forums for awareness, deliberations and planning. Consultants, teacher facilitators, and student trainers provide training and staff development. District- and school-based technical support and contracted services maintain a nearly seamless access to desired technologies. The comprehensive infrastructure of support and inservice leverages the development of human resources.

A new phase of the initiative has been the establishment of a substantial corporate partnership. The partner has a strong interest in technology, student achievement, staff productivity, and organizational change. Projects are underway to transform entire schools through a total technology reinstallation and staff development. One junior high and three elementary schools are designated as Lighthouse Schools where change initiatives are occurring. Each year additional schools will be transformed in a continuous cycle. The high school, soon to undertake a major renovation, is exploring the potential of technologies. Our business partner shares in planning, dialog and evaluation to understand school processes in order to better serve current and future customers. The symbiotic relationship allows each partner opportunities for enhancing intellectual capital.

Our school district is undergoing a transformation that will uplift staff morale, establish new roles and relationships, enhance student achievement and staff productivity, and improve internal, as well as external, communication. The ease of access to information promotes a healthy learning organization. The revolution has begun!

General Session: New Curriculum Designs/Instructional Strategies

The Hot Chocolate House: Engaging Students in Reading and Writing

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Key Words: World Wide Web, HTML, reading, writing, elementary

Introduction

Inspired by a café or coffee house where writers gather, interact, and share their work, the Hot Chocolate House is a Web site managed and maintained by elementary school students and for an audience of elementary school students. Visitors can wander from room to room, visiting, interacting, and engaging with each other in a variety of activities involving reading and writing, learning, and thinking.

Rooms in the Hot Chocolate House

Open Mike

Submit original written work (stories, poems, etc.)

Read written pieces by other students

Book Reviews

Submit book reviews

Read book reviews found on the searchable database

Author's Parlor

Read letters from children's authors

Gather addresses of children's authors

Submit letters received from children's authors

What Should I Write?

Discover new writing ideas

Explore different writing formats

Food

Collect student submitted recipes

Submit favorite recipes

Map

View maps showing locations of contributors

Book Club (under construction)

Take part in a book discussion with other students on the WWW

Mystery Message Hunt (under construction)

Gather clues from books, libraries, and the WWW to discover the mystery message

Rationale

The Hot Chocolate House provides a new and innovative way to address and realize the following curricular goals:

- facilitate interactions between elementary school-aged students from all over the world via the Internet
- foster discussion about literature, reading and writing among elementary school-aged students on the WWW
- expose elementary school-aged students to written work created by, and literature recommended by other elementary school-aged students from all over the world
- provide writing ideas and reading material for elementary school-aged students
- strengthen information gathering skills via use of the library and Internet
- encourage and promote independent reading and writing
- create and support voluntary readers and writers
- facilitate correspondence with children's authors

The Hot Chocolate House is notable in that it is maintained, under the guidance of an adult Webmaster, exclusively by elementary school-aged students, some as young as eight years old. As such, the site provides a hands-on, "real world" lesson in technology implementation. Students:

- learn how to create and maintain a Web page
- shape the structure and content of the Web page
- correspond with contributors via e-mail
- solicit contributions via the Internet
- select, edit, and format written work for publication
- serve as advisors to other students regarding Internet and computer usage

Pull up a comfortable chair, grab a hot drink, and visit the Hot Chocolate House at: http://www.nscds.pvt.k12.il.us/nscds/hch/enter/enter.html

Paper Session

Teacher Change: Making Innovations Explicit

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Key Words: **innovation, change, professional development, telecommunications, multimedia**

Abstract

This paper describes a strategy used for making innovations introduced into a telecommunications and multimedia professional development project explicit and integral as a guide for marking teacher progress in making change in their practice and toward a group goal. Attention is focused on several key technological innovations introduced into the project with a description of how levels of use continually supported participants in their attempts to measure personal and group growth in the project.

Contexts of Technology: Professional Development and Change

The number and kinds of innovations introduced to teachers require change facilitators who have "goals and content that are explicit, operational, and relevant to the needs of teachers" (Bennett, 1994, p. 156). To this end, a telecommunications and multimedia inservice project at Northern Arizona University (NAU) includes the study of an evolving professional development venture that connects university-based preparation with ongoing education of teachers.

Imig (1995, p. 12) calls for professional development that is "radically different than the 'sit and git' inservice that occurs now." He promotes inservice that includes the following characteristics or components: school based, needs based, teacher determined, continuous, integral to the life of the school, and aligned to K–12 content and performance standards. Each of Imig's recommended components requires changes for many teachers: change in thinking and knowing, attitudes, perceptions, ways of doing and being a teacher, and schooling culture. Add to this list the introduction of several new technologies such as multimedia and telecommunications and professional development becomes even more complex.

The professional development of teacher educators in the area of educational technology involves the school context and rate of innovation as much as the facilitation of desired behaviors resulting from learning new technologies. Bennett (1994), for example, writes that the "organizational context or environment of staff development efforts significantly influences the rate and extent to which teachers implement new technology into classroom practice" (p. 153). In another approach, the Concerns-Based Adoption Model (CBAM) asserts that "with diagnostic information the change facilitator can make decisions about how to use resources and provide interventions to individuals to facilitate the school improvement process" (Hord, Rutherford, Huling-Austin & Hall, 1987, p. 10). Additionally, we found that teachers put innovations to use in different ways. As Hord et al. (1987) observe: "a number of patterns emerged, each characterizing a different use of the innovation" (p. 13). We paid careful attention to organizational context and the nature of innovations introduced into that environment in the project described below.

Project Description

Twenty-two teachers from six geographically diverse regions of northern Arizona are participating in the Telecommunications, Environmental Education, and Multimedia (TEEM) project. The two-year project is funded through June 1997 by the USWest Foundation. Teacher teams meet face-to-face three to four times a year on the NAU campus and meet electronically through a project listserv administered at NAU. Several participant schools are located in remote regions in the Navajo Nation with 10 TEEM participants living locally. The project design includes several on-campus seminars, but a majority of the work is done via e-mail and listserv discussions, coupled with project staff visits to school locations to work with teachers in their own classrooms in the project focus areas.

National standards in geography, math and the arts (music, drama and visual arts) have been brought together with Arizona Department of Education environmental education (EE) guidelines in this project to address concerns that schools should be developing and using coherent integrated curriculums. State EE guidelines were chosen in an effort to increase teacher attention to promoting and maintaining a sustainable future. Environmental education seems a natural content for integration. Integration of the content areas of geography, math and the arts were grant mandated but also fulfill a need to integrate an area such as environmental education across diverse curriculum content. This unusual marriage of disciplines presents a real-world problem for teachers as they investigate their own practice and work towards an integrated curriculum. Multimedia and telecommunications technologies seem to be naturals in supporting integrated curriculum development and in supporting a developing community of teachers from diverse and remote locations.

Teacher teams developed EE lessons and instructional multimedia modules based on an environmental waste material theme during a summer workshop at NAU. Teachers worked with instructional design specialists, programmers, artists, and content-area specialists to develop classroom lessons, activities, products, and resources. Modules are linked and have been reproduced on a CD-ROM to provide resources for participant teams for inservice purposes in their schools. The CD consists of introductions to telecommunications, multimedia, curriculum integration, using one computer in a classroom, and equity issues. A World Wide Web homepage (http://tntnet.slc.nau.edu/~teem/) linked to resource locations has been set up as a repository for developed inservice modules. In the second year of the project, teacher-participant teams are planning and will provide nine hours of professional development inservice to their peers using the CD-ROM disc to begin development of school-wide integrated environmental education plans, with inservice also emphasizing telecommunications and multimedia technology applications.

Degrees of Innovations Defined

Participants expressed frustration and guilt after several months into the project: "I feel guilty that I haven't ...." One teacher commented, "I think I should drop out of the project. I feel guilty that I haven't gotten my students online to the Internet. I am getting a phone line into my classroom next semester, but I am not taking them into the teacher work room and getting *them* online" (Field Notes, 11/96). This statement indicated that one teacher's perception of her growth and contribution to the project was clouded by a narrow view of the level of success along the continuum of uses inherent in this innovation. Figure 1 indicates a continuum of use within the project's telecommunication innovation, with teachers in the project falling into all six cells. Many of her project colleagues were still struggling with *any* kind of access to the Internet, yet this teacher fell into the student access cell found on the Telecommunications Innovation Continuum.

Innovation #1: Telecommunications—Levels of Use

training	access	e-mail	listserv	student access	integrated into lessons

Figure 1. Telecommunications Innovation Continuum

The project staff listed and counted innovations inherent in the grant project and found clear reason for participants to be confused and to feel conflict in their levels of participation. It was critical to provide all participants with this same information. Hord et al. (1987, p. 30) identify seven kinds of concerns that users or potential users of an innovation may have. Figure 2 is adapted from those original stages of concerns and includes specific connections to technological innovations. Individual participants in this project are likely to have some degree of concern at all stages at any given time and with any given innovation.

STAGES OF CONCERN & EXPRESSIONS OF CONCERN	CONNECTION TO TECHNOLOGICAL INNOVATIONS in TEEM PROJECT*
Orientation & Informational (I would like to know more about it.)	Participant's awareness grows to include knowledge of an innovation's general characteristics, effects, and requirements for use; participant does not perceive the innovation as relevant to herself but has interest in learning more detail if necessary. She learns about the potential of multimedia and telecommunications.
Personal buy-in (How will using it affect me?)	Participant perceives need to be involved with innovation but is uncertain about adequacy in meeting its demands and about its effect on organizational systems for rewards, decision making, etc. Participant wonders what effects the innovation will have on her personally in terms of money and status. (How will multimedia and/or telecommunications affect me?)
Management concerns (I spend all my time getting ready.)	Participant begins to focus on mastering the processes and tasks of using the innovation well. She learns to use multimedia and/or telecommunications in the classroom.
Impact of change (How is change affecting my students?)	Participant begins to see innovation's impact on her sphere of influence—relevance to student performance is perceived. Participant experiences the positive effects of the change. Focus is on how multimedia and/or telecommunications affect the students and self.
Collaborating (I am relating what I am doing to what other teachers are doing.)	With experience comes confidence. Participant is now ready to exchange ideas, discuss difficulties, and cooperate with others using the innovation. There is an interest in an interaction with others about multimedia and/or telecommunications.

Refocusing (I have some ideas that might work even better.)	Participant wishes to explore additional benefits from the innovation. These might be made possible by advanced training, changes in procedures, or tie-in with another technology. The innovation and its benefits become routine. Participant is open to using the technology in a new and unique manner.

* Critical Analysis, Carol Bly, Sacramento City Unified School District

Figure 2. Stages of Concern (adapted from Hord, et al. 1987 & Bly)

Evaluations of innovations typically focus on the effectiveness of the innovation (Hord, et al. 1987). Nine innovations were identified by both project staff and participants, which may help explain why chaos and conflict seem to rule the project from time to time. Six innovations centered around technology will be detailed in this paper. Examples of innovations identified with real and anticipated levels of use are shown in Figure 3 (telecommunications-based innovations) and Figure 4 (multimedia-based innovations). These innovations lent themselves to an evaluation of process rather than an evaluation of effectiveness of the innovations themselves, at least in the early stages in the project.

Figure 3 provides information on three different innovations in the area of telecommunications: equipment and Internet access, kind of Internet access, use of telecommunications with use of the project listserv specifically. All participants have some kind of access, although that access is limited and often cost-prohibitive. One participating school district located on the Navajo Nation is approximately three hours from the university and Internet access is provided by NAU with toll costs associated with long-distance telephone service. For the purposes of this project, paying long-distance phone charges for access to the Internet is the same as not having access. There is also a difference in the kind of access available to participants. Ten of 22 participants have dial-up access to the Internet through the university, and as such, have no access to a graphical interfaced WWW at this time. All 22 participants have access of some sort and all are subscribed to the project listserv, but only five participants post messages on the listserv, and of those, only one is consistent in his use of the listserv. It should be noted that this listserv was intended as the project's main communication source.

Innovation #2: Equipment & Internet Access—Levels of Use

No access available	Modem and provider to Internet are available but participant does not access	Modem and provider to Internet are available and access is occasional	Modem & access to Internet are used for listserv and mail at least once a week	Modem & access to Internet are used for listserv and mail at least once a week plus student use

Innovation #3: Kind of Internet Access—Levels of Use

No access	Long distance charges to text-based NAU server or graphical interface; access paid by teacher	text-based (no graphical WWW access) NAU server w/local access & no fee to teacher	graphical WWW Interface (use district or commercial provider access such as AOL, SedonaNet, PrimeNet); cost covered by district

Innovation #4: Project Listserv—Levels of Use

Never connects to listserv or Internet access	Occasionally reads listserv messages (less than once a week)	Reads listserv daily to once a week	Posts occasional message for information and/or sharing	Posts frequent messages and information for sharing

Figure 3. TEEM Project Innovation Components

Examples of Levels of Use Continuum—Telecommunications Based. Each column represents a continuum from non-use or orientation on the left to full implementation on the right.

Figure 4 shows levels of use of multimedia by project participants from orientation to full implementation. Multimedia has been deemed by project staff and participants as the most successful innovation in the project. Each teacher team received a Liquid Crystal Display (LCD) projector for their school district. In past telecommunications projects directed by the author, it was recognized that teachers had no way to display a computer screen when they brought the Internet or multimedia applications into classrooms. Nor did teachers have a way to inform administrators, site-based councils or school boards of technology needs. The LCD projectors are used at all participating school sites, and several teams are finding them effective tools to leverage Internet access, to increase funding for technology purchases, and to showcase efforts of their students. An unintended outcome of the project is that with the help of the project's technical specialist, teachers are unearthing unused equipment from storage closets, receiving training on equipment, and finding applications useful to their classrooms.

Innovation #5: Multimedia as a Teaching Tool—Levels of Use

awareness	training	use of projection device and still camera	use of other peripherals (scanner, video, etc.)	use for teaching and/or demonstratio ns	development with or by students

Innovation #6: Multimedia Equipment—Levels of Use

No multimedia equipment available	Multimedia equipment available but not used	Multimedia equipment available and used for teaching and learning by teacher participants when appropriate

Figure 4. TEEM Project Innovation Components

Examples of Levels of Use Continuum—Multimedia Based. Each column represents a continuum from non-use or orientation on the left to full implementation on the right.

The identification of project innovations and levels of use by participants, and then reflection on the innovations by participants and project staff led to a pivotal point in the project. Teachers use the above continua to self report: they are at different places along the continuum of many innovations, and after one year into the project, progress was noted in one or more innovations for every participant or school. Teacher concerns brought out in the open those factors that can not be controlled by the teachers themselves, highlighting the need for school change to occur at a higher plane—at the level of school culture. When factors out of teacher control were made explicit, participants seemed to relax and settle in to the project with renewed vigor. Participant attention was focused away from their individual concerns and began centering on group goals and tasks. When project staff recognized and addressed the sheer number of innovations and the possible levels of use for any one innovation directly by teacher teams, feelings of chaos and confusion lessened as comfort with the complexity increased.

Once the above innovation continua were introduced graphically and used by teachers personally to mark their progress, they began asking for other continua to be developed later in the project. For example, during a summer 1996 workshop, a group of participants developed their own continuum to show progress in developing environmental lessons for the CD-ROM. Wall size posters of project tasks and training topics (e.g., progress in learning to use presentation software, develop Web pages, conceptual design of CD-ROM) for the workshop were made and used periodically during the two-week workshop to show group progress. Whole-group debriefing sessions centered on these wall posters to guide the next day's work. Colored post-its were used as markers and were moved by participants to indicate a group consensus of progress. Discussion established that while individuals might have moved up on levels of use, group growth reflected a definite location on the continuum with some individuals seen as outlyers. It seemed appropriate then, that when a group of participants met to begin CD-ROM design, graphic continua were used to determine progress of design, content and programming tasks.

Conclusion

The professional development environment and careful attention to and analysis of teacher concerns and diverse levels of use of innovations are guiding indicators to the health of this project. An intensive qualitative evaluation accompanying the TEEM project is providing and will continue to provide data for ongoing facilitation of the process and product outcomes, providing opportunities to reflect on technical and non-technical innovations and to modify professional development according to school and teacher needs. Use of innovation continua in this project indicated a positive turning point when participants viewed tasks contributions and personal growth as contributions to a group process and product.

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General Session: Technology Implementation/Educational Reform

Change and Technological Innovations: Teacher Stories

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Key Words: **telecommunications, multimedia, integration, inservice, innovation, change**

A telecommunications and multimedia teacher inservice project at Northern Arizona University (NAU) includes the study of an evolving professional development partnership that connects university-based preparation with ongoing education of teachers. Twenty-two teachers from six geographically diverse regions of northern Arizona are participating in the Telecommunications, Environmental Education, and Multimedia (TEEM) project. Teacher teams meet face-to-face three to four times a year on the NAU campus and meet electronically through a project listserv administered at NAU. Several participant schools are located in remote regions in the Navajo Nation with Nine TEEM participants living locally. The project design includes several on-campus seminars, but a majority of the work is done via e-mail and listserv discussions, coupled with project staff visits to school locations to work with teachers in their own classrooms in the project focus areas. The intent of the project is to pro-actively move beyond traditional forms of inservice efforts through a number of innovations which create change.

National standards in geography, math and the arts (music, drama and visual arts) have been brought together with Arizona Department of Education environmental education (EE) guidelines in this project to address concerns that schools should be developing and-using coherent integrated curriculums. State EE guidelines were chosen in an effort to increase teacher attention to promoting and maintaining a sustainable future. Environmental education seems a natural content for integration. Integration of the content areas of geography, math and the arts were grant mandated but also fulfill a need to integrate an area such as environmental education across diverse curriculum content. This unusual marriage of disciplines presents a real-world problem for teachers as they investigate their own practice and work towards an integrated curriculum. Multimedia and telecommunications technologies seem to be naturals in supporting integrated curriculum development and in supporting a developing community of teachers from diverse and remote locations.

Teacher teams developed EE lessons and instructional multimedia modules based on an environmental waste material theme. Teachers worked with instructional design specialists, programmers, artists, and content-area specialists to develop classroom lessons. Modules are being linked and reproduced on a CD-ROM to provide resources for participant teams for inservice purposes in their schools. The CD consists of introductions to telecommunications, multimedia, curriculum integration, using one computer in a classroom, and equity issues. A World Wide Web home-page linked to resource locations has been set up as a repository for developed inservice modules and will showcase student work. In the second year of the project, teacher-participant teams have planned and provided nine hours of professional development inservice to their peers using the CD-ROM disc.

Teachers in the project have provided direction for the type and content of professional development, processes used to implement change in their schools, and content for a teacher-developed CD-ROM disc which project teacher teams will use for inservice training in their schools spring, 1997. The professional development environment and careful attention to and analysis of teacher concerns and diverse levels of use of innovations are guiding indicators to the health of this project. Using these guidelines gives the project an ever-changing flavor, thus, providing participants and project staff the unsettled feeling of not knowing what will happen next. Within the context of this project, the panelists describe a "circling" process that accompanies the continuously evolving professional development efforts to remain teacher- and school-focused. Panelists will provide individual perspectives of the trials and successes unique to their own professional development, their schools and their role in the project. Research associated with the project will be highlighted and includes themes of technological innovations and change, teacher empowerment and change, and professional development alternatives.

TEEM USWest HomePage: http://tntnet.slc.nau.edu/~teem/

General Session: Technology Implementation/Educational Reform

FoxNet: Bringing Schools and Community Together

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Key Words: **community access networking**

In 1986 Fox Chapel developed the first phase of a voice, video, data network to link students, staff, and the surrounding communities. As part of this initial effort the district's high school was renovated. The building was rewired with a Radio Frequency (RF) video distribution system, an Ethernet data network, and a voice communications system. Each classroom teacher received access to a telephone for communications and classroom management, a terminal (and later a computer) for both the delivery of instruction and the management of instruction, and a 27 inch monitor for the delivery of instruction.

Initially, only the telephone communications opened the door to the community. For the first time teachers could receive and initiate phone calls from the classroom. At this stage community members had no access to Fox Chapel video or data resources

In 1991, using the high school as a model, Fox Chapel developed the second phase of the communications network as part of district-wide renovations. At the same time district staff, community members and parents worked on a Strategic Plan for the district. In 1992 the Board approved the Strategic Plan which included a Communications component that stated:

We will develop a communication network to link schools, students, parents, the community and staff.

In 1994 the second phase of the plan was completed. All elementary classrooms were wired with three student computer stations and a teacher station. All learning spaces were wired for phone and video connectivity. All six educational sites were linked for voice, video and data communications with fiber optic cabling. Beechwood Farms, a local environmental center and the regional home of the Audubon Society, became the first community resource incorporated into the district's network. Beechwood Farms gained Internet access and a means to distribute television programming to the teachers and students in the school district.

Together with local cable providers, Comcast and TCI, the Fox Chapel Area School District investigated the possibility for broadcasting directly into community members' homes. During the winter of 1994 the first broadcast occurred: Fox Chapel beamed over its fiber network a two hour Make A Wish Telethon. The success of this project opened the door for daily programming during the 1995–96 school year. Every day during the school year student productions and bulletin board announcements traveled across the FoxNet fiber links into the homes of TCI customers in boroughs of Fox Chapel, Aspinwall, Sharpsburg and O'Hara Township. During the 1996–97 school year the cable network extended into the homes of the rest of the school district served by Comcast.

Currently we are working with local municipal governments to incorporate general information, such as ordinances, garbage collection, and local zoning, onto our World Wide Web home page. Student teams at the district's high school, as part of a community service project, will design the pages to share with our community members.

As part of our next phase of development we plan to link two additional sites using funds from the Pennsylvania initiative, Link2Learn. The link to the Sharpsburg Center will provide access to our network resources for senior citizens, community members, students during after-school hours, and pre-school educators and children. To link Bradley Center we will use a wireless solution that will provide data connectivity via one of our elementary buildings—Hartwood. The wireless link will enable students with the need for residential emotional support and staff members at Bradley Center to access electronic resources for student record-keeping, Internet use, and a variety of other district applications.

In subsequent years we plan to use Link2Learn funds to connect community centers, local libraries, and municipal buildings to our network. Eventually our community access network will become one of many links in PEN—the Pennsylvania Educational Network.

Paper Session

Integrating Technology Into Primary Grade Language Arts: Research on Apple's Early Language Connections

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Key Words: **technology integration, elementary grades, language arts, reading, teacher development, computer-based instruction, student performance**

Abstract

This paper reports findings from a multi-year study of Apple's Early Language Connections (ELC). ELC includes hardware, software, children's literature, and training focused on technology integration. The study examined ELC's implementation and use in classrooms and its impact on teacher and students. Findings showed teachers integrated technology into instruction with software-driven, project-based, literature-based, or activity-based lessons. Findings on student performance suggest that effects are stronger as children have more experience with the technology.

The Center for Research, Evaluation and Training in Education (CREATE) recently completed a multi-year study of the use and impact of Early Language Connections (ELC) in 16 widely dispersed classrooms. Emerging findings in this study have been reported in Guthrie & Richardson (1995) and Guthrie & Richardson (1996).

Early Language Connections combines children's literature (including over 350 children's books), 3–4 Macintosh computers per classroom, instructional software, and many other curriculum materials, including detailed sample lessons constructed around four thematic units.

Also included are two days of staff development designed to help teachers move beyond the mechanics of using the computers and software to fully integrating into the regular instructional day. The research explored systematically the implementation, use and resulting student performance of the program.

In this paper, we report findings on each of three key questions that guided the research:

1. How is Early Language Connections implemented and used in classrooms?
2. What is the impact of Early Language Connections on teachers?
3. How does Early Language Connections affect student learning?

The Study

The study was conducted at four geographically and demographically diverse sites:

Camden, NJ: 850 students; 99% free-and-reduced lunch; 99% Black and Hispanic
Cape Coral, FL: 930 students; middle to low SES; 15% minority
El Paso, TX: 700 students; 44% FRL; over 70% Hispanic.
Lexington, NE: 400 students; 61% white with a growing LEP population.

The study included one ELC classroom and a comparison at first-grade and second-grade at each school (16 teachers total). Eight Early Language Connections classrooms were identified for intensive study through a nomination and review process. We looked for classrooms where the teacher was implementing the program in ways consistent with its design. Comparison classrooms were selected based on demographics and curriculum comparability. While they had access to technology, it was more incidental to regular instruction and was either in a lab format or only one computer in the classroom. Data were collected through classroom observations, interviews with teachers, samples of student work, and tests of students' reading and writing performance. Classrooms were observed and teachers interviewed at least twice a year. Reading and writing performance was assessed on two occasions: Fall 1995 and Spring 1996.

Findings on Implementation and Classroom Use

Teachers were enthusiastic about ELC as an instructional tool which is both liberating and challenging. Children were excited as well. One of the biggest "problems" for teachers was finding a way to distribute children's time at computers fairly—they wanted to use them all the time.

Teachers preferred to integrate the program in their own way, rather than follow the ELC sample lessons. The Early Language Connections package includes a set of comprehensive units built around the software and children's books and including a variety of activities and projects. It's up to the teachers and students, however, to determine how the program can best fit into and support their own computer-assisted learning tasks. While the expectation was that teachers might systematically work their way through the ELC sample lessons, only a few teachers took that approach. Instead, they preferred to develop their own ways of integrating the ELC activities, choosing books or activities from the sample lessons. They used the manuals as a resource from which they select lesson ideas, strategies, and activities.

Some of the study teachers adapted the program to a standard curriculum, while others fit it into themes or projects they came up with on their own. One district, for example, is committed to a basal reading series. Study teachers in that district incorporated ELC activities like plays, puppet theaters, dancing, and singing, as well as those that are more computer-based into the given themes of basal units. In other districts, teachers integrated elements of ELC into their plans as they develop their own curricular themes.

In all the schools, teachers used ELC for a wide variety of instructional purposes. First, teachers used the computer as an instructional tool. Sometimes, teachers worked at one computer as children gathered around to write a story together, brainstorm ideas for a subsequent lesson, or explore an aspect of technology that all would use later. Second, teachers used computers for producing teaching materials. Many teachers made extensive use of technology for creating word and sentence strips, posters, newsletters, and other aids to instruction, for example. Finally, teachers integrated technology into students' learning activities. There activities were: a) software-driven, b) project-based, c) literature-based, or d) activity-based.

In **software-driven** activities, students were assigned to work with a particular software package, like *Reading Maze* or *Word Munchers*. The programs chosen for software-driven activities usually focused on skills development. In one class for example, each morning during morning roll call and homework check, students took turns competing on *Word Munchers*, identifying words with a common vowel sound. To use these programs effectively, teachers had to monitor student progress, adjusting the level of difficulty as students progressed. Unfortunately, teachers in some classes often were too busy to maintain the appropriate level for each students, so it wasn't unusual to see students practicing skills they had already mastered or that were far beyond their skill level.

Project-based (or theme-based) activities were part of a larger extended project, such as class books, a play, or a bulletin board for the room or school. Collecting student work together in a "book" was a popular project, and classes created books around any number of topics drawn from their other lessons and activities. Most often the final product was laminated and bound for the class. Some teachers also allowed the children to print their page or a smaller version of the book to take home. Teachers commented that when students had sustained silent reading time, the ones created by the class were among the most popular. Projects weren't limited to books, however. Technology's role in preparing for a play, for example, involved not only learning lines, but developing scripts, preparing scenery, and designing construction paper masks and costumes.

Literature-based activities extended literature by having students develop word lists from the story, compose their own versions or endings to a story, illustrate it, make posters based on the story, or put events from the story in proper sequence. Some classes created their own versions of stories they have read, such as *Jack and the Beanstalk* or the *Paper Bag Princess*. One approach was to create alternative endings for stories as a group, with the teacher entering on a computer what the children come up with, or each child might write his or her own ending. In this way, students developed their writing through composing, revising, and publishing their work, either individually or in groups.

Activity-based lessons consisted of stand-alone activities or assignments that incorporated technology, such as holiday and birthday cards, posters, invitations, or compositions. Teachers often asked children to write a story and illustrate it. In some classes, children wrote a first draft, but others allowed students to compose directly on the computer. Teachers consistently reported that their students wrote longer and more complex stories and put in more effort when using the computer. Students also seemed to spend more time developing and polishing their work, because editing was easier and because seeing their work printed out and illustrated provided a strong incentive.

Findings on Teacher Change

ELC appears to have changed the way teachers teach. Observations of classes and conversations with teachers suggest that the product was having a significant impact on how they organize and deliver instruction. In one or more of the ELC classrooms, technology became a part of virtually every lesson; the teacher introduced a center-based approach; or the teacher used more cooperative learning and self-paced instruction. Many of the teachers, were used to a whole-class approach to instruction and found it difficult to integrate computer-based activities into their lessons. They could assign a few children at a time to work at the computers, but rotating them through the computer "station" meant the total lesson time and the time for each child to have a turn had to be equal. Instead, they experimented with a center-based approach, in which all children rotated through a series of "centers" or activity stations where they completed a specific task. One center used technology, and others might include reading, workbook, or art activities. Other times, teachers organized instruction around centers that were all part of a larger activity, such as writing a composition. In either case, using centers meant a dramatic and sometimes difficult shift for some teachers. Access to technology was equitable, but planning and classroom management were more difficult. For that reason, an additional day of training on integrating technology and using center-based instruction was provided the study teachers.

Training is essential. Many of the teachers told us that they do not believe they could have been successful using the product without prior training. Not only because they were unfamiliar with computers and technology, but because the challenge of integrating technology into their lessons. ELC includes two days of training, and research teachers were provided an additional two days of training that focused on integrating technology into the curriculum and organizing instruction around centers. In that training, teachers developed plans for how to make changes in their classroom organization and management, and curriculum.

Administrator and colleague support are important factors in successful implementation and use of ELC. In three of the research schools, the principal or another administrator in the school was the driving force behind the introduction of technology. These administrators not only provided the resources for equipment and training, but emphasized the importance of integrating computer technology in their everyday interactions with staff. We found fuller implementations in schools in which several teachers had experience ELC or other technology programs, and in which those teachers collaborated and supported one another.

ELC findings are consistent with the Apple Classrooms of Tomorrow (ACOT) research in terms of teacher development (Dwyer, 1994). Teachers in the study appear to be going through the evolutionary stages of instruction: entry, adoption, adaptation, appropriation, and invention. While none has reached the invention stage, several are beginning to "appropriate" the technology for their own use.

Findings on Student Performance

Students were enthusiastic about technology and eager to use the computers. Observations of classes and interviews with teachers showed that students appeared to be drawn to technology and intrinsically motivated to use computers. At each site visited, we observed students actively and enthusiastically engaged in using the Early Language Connections equipment and software. Students were always eager to have their time at the computer, whether to complete an assignment from the teacher or to engage in activities of their choice.

Teachers also reported that students are writing more and more often when they use technology. In addition to the intrinsic motivation that technology offered most children, knowing that their compositions and illustrations will be printed out and published for others to see was a strong incentive for many.

Reading Performance

Reading performance was measured with a standardized test of reading, the Gates-MacGinitie Reading Test (GMRT). This test has nine levels and is designed to assess reading for grades 1–12. We administered Level 1–2 (Grades 1–2). The test includes a vocabulary and a comprehension section in which students answer questions in a multiple-choice format. The comprehension passages represent a balance of narrative and non-narrative modes and of fiction, poetry, and content area materials and include a cross-section of semantic structures. Vocabulary words were chosen from standard lists and represent the different parts of speech. In the vocabulary section, students choose the word that goes with a picture. Findings from the administration of the test showed that:

Overall, ELC classrooms performed as well or better on the GMRT than the comparison classes. GMRT was administered Fall 1995 and Spring 1996. In both administrations, ELC classrooms scored higher at both 1st and 2nd grade, on both the vocabulary and comprehension portions of the test.

At first grade, both ELC and comparison students scored close to average for their grade level on the test. Table 1 shows mean raw scores, normal curve equivalents (NCE), and national percentile rankings for the first graders. Normal Curve Equivalent scores reflect reading achievement on a normalized curve of 99 equal units with a mean of 50. An NCE of 60 suggests a score that's about one-half standard deviation above average. An NCE gain of 4 or more would indicate an increase in achievement. NCE scores of first graders in both ELC and comparison groups increased over 10 NCEs. Gains for both group were dramatic.

Table 1. Grade 1 Gates-MacGinities Reading Test
Grade Equivalent Scores and Percentile Ranking: Fall to Spring

	Vocabulary		Comprehension		Total	
	Fall	Spring	Fall	Spring	Fall	Spring
Mean Raw Scores						
ELC	18.2	32.8	18.2	32.2	36.5	65.1
Comparison	15.7	30.2	16.2	30.7	31.2	60.9
Normal Curve Equivalent Scores						
ELC	40	52	38	49	37	50
Comparison	35	47	34	46	31	46
Percentile Ranking						
ELC	32	55	29	49	26	49
Comparison	23	44	21	43	18	43

Second grade results on the GMRT (Table 2) reflected a somewhat different pattern. ELC second graders scored much better on the vocabulary portion of the test in the fall, and then made greater gains in the spring. In terms of Normal Curve Equivalent scores, they increased from 55 to 61, while the comparison children moved 44 to 45. This increase represents a gain of 6 NCEs for the ELC group, but only 1 NCE for the comparison students. In percentile rankings, the ELC group increased their ranking 11 percentage points to the 71st percentile, while the comparison students went from the 39th to 41st percentile. This suggests that more experience with technology through Early Language Connections could have an effect on student achievement. The second graders used ELC in their first grade classrooms as well; thus, they had used the program for 2 years.

Table 2. Grade 2 Gates-MacGinitie Reading Test
Grade Equivalent Scores and Percentile Ranking: Fall to Spring

	Vocabulary		Comprehension		Total	
	Fall	Spring	Fall	Spring	Fall	Spring
Mean Raw Scores						
ELC	28.3	37.2	33.9	39.1	62.2	73.7
Comparison	23.7	31.8	26.6	34.1	50.36	66
Normal Curve Equivalent Scores						
ELC	55	61	57	55	57	60
Comparison	44	45	42	44	43	45

Percentile Ranking						
ELC	60	71	63	60	64	68
Comparison	39	41	36	40	37	41

Writing Performance

To assess writing, students were given 30 minutes to complete a story based upon a common prompt. In fall 1995, the prompt was "Once there was a boy and his dog;" in spring 1996, it was "Once I had a funny friend."

Compositions were scored using a 6-point holistic scoring rubric that was developed in conjunction with first and second grade teachers. Classroom teachers with experience in conducting holistic scoring were trained in using the rubric and conducted the scoring. One-fourth of the samples were scored twice to ensure reliability among scorers.

Timed writing scores for Grade 1 showed that ELC students performed better than the comparison group in the fall on a 6 point scale (1.9 to 1.45), but both groups scored the same in the spring (2.67). Grade 2 ELC students performed somewhat better on the writing sample than their counterparts. While ELC students scored a consistent 3.9 in fall and spring, the comparison group dropped from 3.6 in the fall to 3.07 in the spring sample.

Conclusion

Findings of Early Language Connections research suggest that primary grade teachers with only limited experience in using computers found exciting and creative ways to integrate technology into their regular curriculum and instruction. Teachers preferred to develop and design their own strategies for using technology, rather than rely on model lessons, so that no two teachers used Early Language Connections in exactly the same way. All the teachers used computers for a variety of instructional purposes, however, from skills practice to long term projects.

Technical and administrative support appeared to be essential. Professional development that focused on instructional uses of technology and went beyond the mechanics of using equipment and software was of particular importance.

Primary grade children were enthusiastic about using computers as part of their lessons and preliminary findings show academic benefits as well. Measures of vocabulary, reading comprehension, and writing all showed students in Early Language Connections classes were performing as well or better than peers in less technology-rich classrooms.

Scores of first graders in the two groups on vocabulary, comprehension, and timed writing were roughly equivalent. The second grade ELC group, however, who had used Early Language connections in their first grade classrooms as well, scored higher than their comparisons on vocabulary and somewhat better in timed writing. This suggests that effects of integrating technology into classroom lessons may be stronger as children have more experience with the technology. Another explanation might be the effects of access to technology increase as children mature and as the reading and writing tasks become more complex.

Key features of Early Language Connections appear to be the flexibility that it offers teachers—in terms of the different resources it provides and how teachers can use them; the inclusion of quality materials, such as children's literature, and software; and the training and support focused on technology integration.

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Traditional Poster Session

Put Pizzazz in the Curriculum With Internet Projects

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Key Words: **Internet, online, interdisciplinary, develop, design, facilitate, project, handouts**

Abstract

An exciting and fun way to put pizzazz into the existing K–12 curriculum is the use of Internet projects. The Department of Defense Education Activity (DoDEA) shares classroom and management experiences of the Internet project, Around the World with DoDEA conducted during the 1996–97 school year. From this Traditional Poster, K–12 educators receive information on how to successfully participate in an Internet project or how to develop an original Internet project for use in their classrooms.

A project overview is to be presented through a 10 minute multimedia presentation followed by discussion of first-hand experiences from participants and organizers. A question and answer period concludes the Traditional Poster. Handouts include a timeline for Internet project development, hints and tips sheet for successful participation in an Internet project, and sources of other exemplary Internet projects for the K–12 classroom.

The Around the World with DoDEA project is a K–12 interdisciplinary project focusing on the unique opportunity students attending the DoDEA schools have to explore first hand different cultures throughout the world. Students need to prepare for living and working in today's global society. To be successful students must have the skills to work with and understand people of different cultures. Around the World with DoDEA introduces K–12 students to global differences they will encounter in their daily lives.

Around the World with DoDEA has three grade level components. Each of the components differs in the approach students use to accomplish the objectives.

Where in the World Is Turbo? is the K–4 grade level component. Turbo, DoDEA's Junior Ambassador, visits DoDEA K–4 grade level schools located in different regions of the world. Students of the school hosting Turbo write entries in Turbo's online journal giving clues to their host country's identity. DoDEA students that are not being visited by Turbo attempt to discover from the clues what country Turbo is visiting. All students are encouraged to explore their host country and share with Turbo what he would experience if he visited their country.

The Newshound, the 5–8 grade level component, is a student generated online newsletter that focuses on the host countries of DoDEA schools. Student generated articles include current events, nature, weather reports, travel, and recipes, of the school's host country. Student art and photography supporting the articles are encouraged.

Great Escapes, the 9–12 grade level component, is a virtual travel agency created by students for students. After researching the attractions, transportation, lodgings, and restaurants in the host country that are of interest to teenage travelers, the students prepare travel brochures that encourage teenagers to visit the area. Students may present their travel brochures as a home page and/or multimedia project.

This Traditional Poster is designed to motivate and provide guidance in successful participation or development of an Internet project by K–12 teachers and computer coordinators.

Related Handouts, Resources, and URLs

Session handouts and related Internet resources are located under Around the World with DoDEA on the DoDEA Education Web site at URL: http://www.tmn.com/dodea/dodea.htm.

General Session: Current/Emerging Technologies

Gender Issues: How Women Position Themselves and are Positioned by Others in the Area of Educational Technology

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Key Words: **gender, women, technology**

Introduction

Is there such a thing as a gendered response to technology applications? If so what are the implications for preservice and K–12 planning? This presentation aims to increase knowledge and empathic understanding of women's experience with educational technology. Questions addressed include how women are positioned and how they position themselves in an educational technology environment.

A look at history and key contributions made by innovative females in the area of technology provides an overview for contextualizing the experiences of young girls today. Results from qualitative research on women and technology, conducted by the two presenters, are examined. Dr. Hanor reveals the nature of fifth grade girls' aesthetic experiences, including their perceptions, enjoyment and judgment as they are engaged at computers. Dr. Butler examines historical contributions of women to educational technology, using early audiovisual texts as benchmarks of the field. Included is an examination of the essential nature of technology itself, the field of possibilities as determined by students, and issues of gender and positioning.

Theoretical Framework

Feminist theory often aims to bring those who are marginalized to the center. Feminist pedagogy also attempts to reveal how various technologies can encourage or discourage the process of giving centered voice to marginalized people (Felski, 1989; Yeaman, Koetting, & Nichols, 1994). These studies required approaches and methodology which would help gain experiential understandings of the positioning of and by women in educational technology.

The theoretical framework which shaped Hanor's inquiry was derived in part by pragmatic beliefs in the interrelatedness of theory and action. Applying a social constructivist stance in which meaning is negotiated and formed within a community, care was given for who "spoke" in these studies. Whose voice was heard and how was it amplified? Stories were interwoven with those of students to create a response to stories as ideas, to achieve a collaborative 'signature' or writer identity. As noted by Witherell and Noddings (1991), "As chroniclers of our own stories, we write to create ourselves, to give voice to our experiences, to learn who we are and who we have been" (p. 111). This is significant to Hanor's study because it also serves a greater purpose for these girls' voices—"adding to the collective voice we call culture" (Witherell and Noddings, 1991, p. 111).

Butler's study explored authors' discourses in order to uncover ideas and concepts—influencing gender issues in audiovisual education—which were included and/or excluded from writings and conversations. Because there is no standard methodology for a discourse analysis of historical audiovisual texts, working concepts of text, reader, author, subjectivity, sex, and gender were drawn from a number of sources: social reader theories, critical feminism, and discourse as informed by post-structural concepts. Additionally, rhetorical findings were positioned, via discourse analysis, in the discourses which produced them.

What we seek to provide in this paper is a description that is based not on categories but on positionality and relations. What is perceived as marginal at any given time depends on the position one occupies. Emerging out of feminist scholarship, the concept of positionality refers to the idea that people are defined not in terms of fixed identities, but by their location within shifting networks of relationships, which can be analyzed and changed (Maher & Tetreault, 1994).

Stories From the Past

Butler's study, "Women in Audiovisual Education, 1920–1957: A Discourse Analysis," analyzed the creation of subjects within the dominant discourse of audiovisual education, 1920–1957, and the role of women in particular. This research established that the dominant perception of women in audiovisual education, 1920–1957, was that of helpmate to (male) audiovisual specialists. Factors which created and fed such a perception included: the two world wars, the military establishment, the corporate world, and the federal government (for the most part, all patriarchal/male-dominated institutions). Although societal and cultural influences of the 1800s were changing in the first half of the twentieth century, societal perceptions still established that men were providers while women cared for home and family. Alternative discourses influenced by Edgar Dale, John Dewey, and the child-centered learning theory movement also existed within this environment. These alternate discourses provided their readers with choices; they were invited to view the world in more equitable terms. Such perceptions, and the discourses influenced by them, affected how both sexes were viewed within audiovisual education, 1920–1957 (Butler, 1995).

Stories of the Present

Hanor's research with fifth graders addressed the questions: What are the multiple forms of young girls' engagement with computers? What aesthetic choices do girls make with computers and what contributes to this choice making? How do girls position themselves in their aesthetic experiences with computers? Data were collected through observation, interviews, symbolic representational interviews, video, readings by students of their transcribed interviews, and a close study of the aesthetic engagement of two girls.

Students' experiences revealed an integration of both cognitive & perceptual responses of playfulness, repetition, daydreaming & fantasy. Emerging themes indicated girls' identification of their realm of possibilities. They preferred experiencing software applications as themselves rather than being provided key figures from which they could choose to identify. Girls expressed a fear that something was either too fun or too compelling in an activity at the computer and perhaps was beyond their control. This raised questions and speculation as to whether this was a gendered response that was beginning to evidence itself.

This study reinforced the relationships of students' aesthetic experiences to educational experiences with technology.

Summary/Recommendations for Classroom Practice

For those involved in the design and production as well as the utilization of educational software, Butler and Hanor's combined research suggests accepting responsibility for such things as the impact of choices which are offered to students. In making choices available through computers, considerations must encompass the interests and needs of diversified and multicultural populations. Within computer applications, greater opportunities need to be provided for students to interact on a personal level, as themselves, rather than as previously defined and limited characters. One might ask, what societal or cultural molds are furthered within educational technology ?

1. Is there such thing as a gendered response or is it in the language that people hear and use?
2. Is sex differential treatment in the classroom, textbook language, and how individuals are treated in society influential in how individuals view themselves and are viewed by others?
3. Does sex differential treatment mean that girls and boys will learn differently, given non-print media?
4. Is there a gender achievement gap, re: computers (today)?
5. Was there a gender achievement gap, re: audiovisual equipment and materials (historically)?
6. Was there educational equity in audiovisual education of the past?
7. Is there educational equity in non-print education (especially computers) today?
8. Was there sexism in AV education in the past?
9. Is there sexism in the schools today?
10. Is there a double-standard in computer usage and ability between girls and boys today? In the past?
11. Do societal expectations affect how the two sexes learn?
12. Sexism and youth—does it exist in today's educational system? Did it exist in the past?

General Session: Improved Productivity/Administration

Software Resource Management: Getting the Best for Less

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Key Words: **software resource management, resource library**

Overview

When computer technology first came into the Houston Independent School District, a Bureau of Technology was established. One of its purposes was to lead in the identification and selection of software for instructional use. The Software Resource Library, part of the Division of Instructional Division (DOIT) of Houston's Department of Technology and Information Systems, currently serves that purpose.

With the advent of site-based management and purchasing decentralization within the district, schools are free to choose any materials that meet their instructional needs. Because schools have this freedom, the Software Resource Library endeavors to provide as much information to schools as possible to facilitate informed decision-making. The Library tries to keep an up-to-date collection of quality instructional software for computer users to preview, and will arrange for special previews and demonstrations when necessary.

We also participate in a variety of Purchase Plans and License Agreements that include some of the best software around today.

Handout: Software Resource Library Services

General Session: New Curriculum Designs/Instructional Strategies

Simple, But Not Easy: Practical Lessons in Telementoring

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Key Words: **telementoring, subject matter experts, online facilitation, curriculum**

There are now more than 42 million people worldwide with access to global electronic mail. Many of these millions are subject matter specialists whose knowledge encompasses a wide spectrum of expertise. What if "matches" could be made so that volunteers from among this group could communicate directly with K–12 students and teachers who are studying about these experts' specialties?

There are a few online efforts that bring people together in this way. One, the *Electronic Emissary Project,* is an Internet-based interpersonal resource that has been in operation since February of 1993. It is global in scope, but is coordinated from the University of Texas at Austin, and is funded by both the Texas Center for Educational Technology and the JC Penney Corporation. The Emissary is a "matching service" that helps teachers with access to electronic mail locate other Internet account-holders who are experts in different disciplines, for purposes of setting up curriculum-based, electronic exchanges among the teachers, their students, and the experts. In this way, the interaction that occurs among teachers and students face-to-face in the classroom is supplemented and extended by exchanges that occur among teachers, students, and experts asynchronously via electronic mail. The Emissary is also a research project, which has as its focus exploring the nature of adult-child, text-based interaction in which students are active inquirers.

"This is easy!" you might be thinking now. "Just give people each others' Internet addresses and a few suggestions about netiquette, and the conversations are sure to be successful!"

That's what we thought and had expected, also, nearly four years ago, during the pilot phase of the project. We assumed that if folks already knew how to use electronic mail and wanted to communicate with each other, all that we needed to do was to act as a virtual introductions service. We were wrong. We had overlooked the very real challenges of time, medium, and differing expectations. We quickly discovered the critical need and important role for the *online facilitator.*

Communication by electronic mail is different from most other forms of interchange in significant ways. It is asynchronous, primarily text-based, and relatively fast, with participants often widely geographically distributed. It lacks the full spectrum of visual and audible information that we depend upon, often unconsciously, in face-to-face exchange. Therefore, it requires somewhat different interaction strategies if it is to be used to create maximal educational benefit by and for students and teachers. These techniques can be directly suggested by someone closely following the online conversations as a facilitator, helping participants to construct the teaching/learning experience in mutually beneficial ways. Our Emissary work has led us to recognize that the people best prepared to do this are those having the requisite experience in both Internet-based communication and education to know how to help project participants build mutually accessible bridges between their differing workplaces.

The contexts in which subject matter experts ("SMEs") work are quite different from most K–12 teaching/learning environments. Of particular note are differences in Internet accessibility, and the expectations that these contrasts can create. Most subject matter experts have easy and frequent access to telecomputing tools throughout their workday, and are accustomed to having brief, multi-turn, text-based conversations with colleagues with quick turnaround times. K–12 students and teachers have much less frequent and much more inconvenient access to telecommunications facilities. Whereas a SME might expect a reply to an e-mail message within 24 hours, many K–12 students are able to use Internet facilities only once weekly.

Lack of time is a challenge common to workers in both classroom and non-classroom environments, although the logistical nature of time considerations in K–12 spaces is often foreign to those working in other contexts. A scientist from Idaho, for example, became frustrated and eventually offended when his multiple messages to a Texas science teacher and her students were not answered for several weeks. Naturally-occurring situations such as these have taught us much about how to bring experts virtually into the classroom with success. We plan to share our current understanding of how to do this at NECC '97.

Students and teachers of the Information Age need to be able to make connections outside the geographic and temporal bounds of their communities. Their mentors should include subject matter and pedagogical experts from both down the hall and around the globe. Although bringing people together for purposes of telecollaboration can be a challenging endeavor, the benefits for everyone involved far outweigh the inconveniences and miscommunications encountered. We at the *Electronic Emissary* will continue to bring mentors virtually to K–12 classrooms, learning from the challenges that such service engenders, and sharing our realizations with interested others.

More information about the Electronic Emissary Project is available online at: **http://www.tapr.org/emissary/**

Spotlight Presentation

Form Follows Function: Web Page Architecture for Educational Telecomputing Projects

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Key Words: **K–12 curricula, telecomputing projects, Web page design**

Currently, Web page design is primarily addressed in terms of *form* and *content*, rather than function. We consider, for example, layout options (i.e., "Should we use frames?"), overall structure (i.e., "One long page with links to subsections or multiple, shorter pages?"), transfer time (i.e., "How many graphics should I put on this page?"), browser differences (i.e., "Will *Lynx* users be able to benefit from my site?"), readability (i.e., "Does this combination of background pattern and text color make the page difficult to decipher?") and aesthetics (i.e., "Is the combination of colors, items, and spacing pleasing to the eye?"). In my presentation at NECC '97, I will suggest that we also consider project-related *functions* as we design WWW documents.

Project-Related Page Functions

Many good examples of educational telecomputing projects that are supported by Web pages are accessible at **http://teach.virginia.edu/go/mining/97/feb/**. These links are organized both by Web page functions and by activity structures. Let's examine aspects of a few of these WWW documents here to illustrate 10 different project page functions. More information about each is, of course, available on the Web.

1. Project Overview

Web sites can serve as succinct introductions *to the goals and operational structures for educational telecomputing projects.*

For example, the Canadian Kids from Kanata project is overviewed on its Web page (http://www.web.apc.org/KFK/kfkhome.html), offering a general description of this global classroom effort to encourage communication among indigenous peoples and later immigrants. Included on the page is a brief history of the project, an explanation of how the communicating groups are organized, summaries of praise that the project has received in the past, supporting organizations and individuals, and links enabling page visitors to fill out an application to participate and/or e-mail organizers with questions.

2. Project Announcement

Web sites can announce *curriculum-based projects, inviting participation and providing links to relevant networked resources.*

The U.K.-based *Chatback* project collection sponsors Memories from 1945 (http://spectrum.tcns.co.uk/chatback/welcome.html), an electronic appearance activity that helps senior citizens to communicate with students about their memories of experiences during World War II. The main page for this project includes enticing introductions to the seniors available for communication, plus information on how to subscribe to the project's electronic mail discussion list, links to stories about people's WWII experiences, and sample project work from students in Cottage Grove, Minnesota.

3. Project Instructions

Web sites can provide specific instructions *to telecollaborators on how to participate in the educational project.*

I*EARN's excellently organized Learning Circle global classroom projects (http://www.iearn.org/iearn/circles/lc-home.html), for example, are supported by a hypertextually linked set of carefully crafted and information-rich Web pages, which provide specific step-by-step instructions for project participation. The page also contains information on joining I*EARN, links to conferencing spaces in which project partners communicate, and a chronologically organized timeline for the first session of Learning Circle 1996–97 telecollaboration.

4. Information Repository and Exchange

Web sites can serve as virtual places for project participants to exchange information.

KIDLINK's long-term Multi-Cultural Calendar database creation project site (http://www.kidlink.org/KIDPROJ/MCC/) cross-indexes student-written depictions of hundreds of holidays and festivals from around the world. The holiday descriptions are accessible by month, holiday name, country, and author. A World Wide Web-based form is also available at the site, so that new entries for the holiday database can be submitted more easily.

5. Context for Project-Related Communication

Web pages can be co-constructed by project participants, creating an open-ended form of multimedia communication.

The Electronic Emissary telementoring project (http://www.tapr.org/emissary/), which "matches" volunteer subject matter experts with students and teachers interested in inquiry-based learning in the experts' specializations, has seen a few electronic teams co-create Web pages to facilitate their virtual interactions. This is especially effective when pictures or diagrams need to be concurrently viewed, and can be supplemented by real-time audio/video interaction using *CUSeeMe*.

6. Project Support

Web sites can serve as organized collections of project-related resources.

CoVis' rich and well-organized site (http://www.covis.nwu.edu/) offers a plethora of materials that can be used by participants as they explore geosciences in telementoring contexts, "learning through collaborative visualization." CoVis page architects have clearly shown that the key to making project support sites maximally useful to project participants is to organize the materials offered for quick and efficient access.

7. Project Chronology

Web sites can present chronologies of past and ongoing project work.

A beautiful page greets GlobaLearn's (http://www.globalearn.org/) Web site visitors. In early 1997, selecting the "Black Sea Expedition" icon allowed viewers to see rich artifacts of many types that trace the experiences of a group of students who traveled for eight weeks around the Black Sea, beginning and ending in Istanbul. In taking this trip and telecommunicating with students as they did so, the "expedition team" provided telefieldtrip opportunities for 5000 other students from all over the world. Other expeditions have since begun, and are similarly chronicled at this site.

8. Showcase of Participants' Works

Web sites can provide viewing space to share project participants' creations.

MidLink Magazine (http://longwood.cs.ucf.edu/~MidLink/), an electronic publishing project for "kids in the middle grades," publishes students' art and writing four times each year. Each issue of this "e-zine" is actually a thematically-linked collection of students' works that were associated with different educational telecomputing projects.

9. Project Center

Web sites can serve as multipurpose centers, *combining several of the project-related functions listed above.*

The main menu for the Global SchoolNet's KidsPeak telefieldtrip project (http://www.gsn.org/gsn/proj/everest/), which followed mountain climber Sandy Hill Pittman as she and her team ascended Mount Everest in 1996, illustrates well how many of the page functions mentioned earlier in this article can be combined to create an information-rich, facilitative, multipurpose "virtual center" for an educational telecomputing project.

10. Project-Spawning Service

Web sites can offer electronic services *that can help to initiate new curriculum-based telecomputing projects.*

A growing number of services that help teachers and students locate information and interpersonal contacts with which they can begin new projects are now available on the Web. Notable among these is a keypal and global classroom partner locator, the Intercultural E-Mail Classroom Connections service (http://www.stolaf.edu/network/iecc/).

Hopefully, the 10 Web site functions explained above will help you to allow function to drive form as you design Web pages to support current and future educational telecomputing projects.

Workshop

Teaching Teachers to Use Telecomputing Tools

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Key Words: **professional development, innovation diffusion, telecomputing, teacher educators**

What methods and models are most successful in helping teachers to be competent and comfortable in cyberspace? This workshop will use the results of research on the diffusion of innovations to assist teachers' teachers in planning and implementing effective inservice and preservice telecomputing workshops. Content, structure, audience, and support issues will be discussed.

The results of Everett Rogers' well-known work on the diffusion of telecommunications innovations can significantly assist those teachers who have telecomputing training responsibilities. Rogers' work shows how telecommunications innovations are different from other types of new technologies, and how these differences must be addressed for efforts to work. He also stresses the need for each adopter to "re-invent" the technology, adapting it to their own unique needs, thereby making it "their own."

This important aspect of assisting teachers to adopt telecomputing innovations, which Rogers calls *reinvention*, can be addressed by helping teachers to use *activity structures* to plan meaningful, curriculum-based, customized educational experiences that incorporate use of telecomputing tools. The 20 telecollaborative and 5 teleresearch activity structures that Judi has derived from hundreds of examples of K–12 educational telecomputing projects will be referenced during this workshop, along with suggestions for how to help teachers to learn to use them in their planning.

Rogers' suggestions, adapted for use within K–12 contexts, and K–12-specific telecomputing innovation diffusion ideas, will be shared, along with different models for telecomputing training (that can address the different needs and limitations extant in the many different connectivity configurations represented at different schools), and practical "tips" for telecomputing trainers garnered from Judi's many years of helping teachers to learn to use telecomputing tools. Although the workshop is proposed as a non-computer-based session, many different small-group and large-group experiences will be coordinated, so that participants' learning is as active and interactive as possible.

General Session: New Curriculum Designs/Instructional Strategies

Mapping Your Way Across the Curriculum

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Key Words: **geography, maps, community, primary, elementary, cross-curricular**

For children, geography is their place in the world and history is their life. Understanding this microcosm is the first step in understanding the world at large. We empower children when we make them comfortable with their surroundings and prepare them to explore beyond.

Maps are the tools that guide children as they venture out. They show children where they are, where they've been, and where they can go. Maps help them establish a sense of identity, belonging, and history. Through maps, children clarify their connectedness to the world, its people, and all of its creatures.

This session will feature an innovative mapping tool that supports your geography goals and other cross-curricular objectives for grades K–5. The software allows teachers and students to draw roads, add natural features, stamp buildings and landmarks, and then add pictures, narration, photos, and even movies. Students explore their towns and complete activities and challenges that involve their understanding of direction, symbols, scale and distance, grid coordinates, and other essential geography skills and concepts. They even create their own original mystery challenges and use the slide show feature to chronicle their town's history and create multimedia tours.

The presenter will demonstrate the program, suggest dozens of practical and exciting ideas for integrating geography across the curriculum, and share a variety of student projects.

Traditional Poster Session

Educating Hospitalized and Chronically Ill Students With Virtual Reality

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Key Words: **learning, virtual reality, chronic illness, cancer, hospitalized students**

Frequent medical appointments and intermittent, potentially long-term hospitalizations remove a student with a chronic illness from the normal school environment. While hospital school programs and home tutors provided by school districts serve to assist students unable to attend class, direct instruction is limited by many external factors. Learning can attenuate, and important social development is disrupted.

In this poster presentation, Michael Herbert and the Human Interface Technology Lab (HITLab) at the University of Washington present two innovative research projects using virtual reality (VR) technology to provide educational continuity and opportunities to hospitalized and placebound students with chronic illness.

With VR technology, users can be immersed in an three-dimensional environment that offers unique experiences that are consistent with successful learning strategies, experiential, intuitive, allows natural interaction with information, a shared experience, and can be configured for individual learning and performance styles. Researchers claim learning in an immersive environment leads to better conceptual understanding of the subject (when compared to recall of facts) than learning in other ways.

Presented is "The Virtual Classroom," in which students hospitalized at Children's Hospital in Seattle share learning experiences with students in a public school classroom. Students at both sites collaborate in activities designed to help them learn about global warming. The networked, multi-participant environment also removes the psychosocial barriers created by the need to successfully manage a chronic illness.

"Cell World," a virtual environment concept designed for use by students receiving treatment for cancer, is also introduced. Instructional activities include learning basic cell biology and functions by constructing and interacting with healthy, mature white blood cells. Understanding the role of white blood cells is key over the course of cancer treatment.

Can learning in VR assist the treatment and healing process? Ultimately, recovery begins with learning. Effective patient education helps to demystify the diagnosis and treatment, and provides the means to regaining important control over the disease. Additionally, research has suggested that a variety of psychological interventions can be effective in reducing or preventing conditional side effects associated with chemotherapy. Relaxation and/or mental imagery has been shown to influence the production of antibodies. It is speculated that the use of mental imagery techniques influences the course of cancer. Specific interactions between neural processes and cell function are difficult to ignore. In "Cell World," a hypothesis is made that the use of VR can assist to promote healthy imaging, perhaps provoking a type of biophysical, "cybersomatic" process, enabling the production of real white blood cells or the elimination of disease.

Michael Herbert, M.Ed, educational technologist, has over 20 years experience in education, including 10 years teaching students with chronic illness at the Children's Hospital in Seattle, WA. Currently, he is a visiting scholar with the HITLab researching educational and therapeutic applications in virtual reality. The HITLab at the University of Washington works to empower people by building better interfaces with advanced machines that will link minds globally and unlock the power of human intelligence.

Select References Related to Abstract

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URLs

Human Interface Technology Lab: http://www.hitl.washington.edu

A most impressive resource for information related to VR; the place to start your search. Be sure to look at the Knowledge Base under Projects.

The Virtual Reality and Educational Laboratory East Carolina University
http://eastnet/educ.ecu.edu/vr/vrel1.htm

General Session: New Curriculum Designs/Instructional Strategies

The Internet, a Children's Literature Class, and Preservice Teachers

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Key Words: **Internet, World Wide Web, preservice teachers, technology, teacher training, appropriate use of the Internet in the classroom**

Although I have been involved in teaching educators to use computers and encouraging them to integrate technology into their classrooms for over 10 years, today, I spend more time than in the past encouraging them to think about using technology appropriately. In evaluating my use of the Internet as a resource in my classes in the fall of 1996 and spring of 1997 at Saint Martin's College, I have started to look at what others are doing in this area. A good sample of courses that are using the Internet can be found at the World Lecture Hall (UT Austin, 1997). There are also recent articles that question whether the Internet can be used effectively for teaching in higher education (Owston, 1997, Trentin, 1996), as well as articles that question whether we are using computers and technology for the right reasons (Salomon and Perkins, 1996).

In this NECC session I hope to not only tell about my experience using the Internet for a class resource, but also, start a discussion on finding appropriate uses for the Internet in the classroom. Part of this discussion is to identify the unique properties of the Internet, and then see how it can support learning. If you are interested in joining in this discussion, write me, or visit DeLiberations, an online magazine that encourages this kind of discussion, as well as providing information on similar topics. A hypertext version of this article as well as my Web page for the Children's Literature class can be found at:

http://weber.u.washington.edu/~belinda/necc_lit.html

Why I Choose to Use the Internet Instead of a Textbook

While planning for a class on children's literature I decided to try the Internet as an alternative source for materials for the class. Selecting appropriate resource materials for college classes poses some interesting challenges. Textbooks often don't contain all of the subjects that you want to cover, especially current materials. Finding journal and magazine articles to cover all the subjects is time consuming, and staying within copyright laws takes up even more time. Both textbooks and articles can be expensive, and students resent spending money on materials that are often not used after the class. Choosing to use the Internet instead of books or other copied material solved several of these problems, and has proven to be an overall positive experience for me, as instructor, as well as the students taking the class.

Finding the materials that I wanted to include and putting together a Web page took some extra time and work but the advantages that were gained in being able to tailor the materials to my teaching were worth the effort. Many sites have the most up to date materials available, such as the Newbery and Caldecott site which has the winners for 1997, as well as all the past medal and honor books. Or if someone in class asked about recent banned books, there are several places that we can go to find out what books have been banned, both recently and in the past. On issues like the relationship of TV and reading or the depiction of Native Americans in children's books, I have found excellent articles that the students can read online or copy to read later.

Not only have I found a wide variety of materials online that fit the subjects and issues that I want to address, but the students can branch out and find related or in depth materials that they are particularly interested in studying. From a site that tells about using Reader's Theater, they can find scripts, lesson plans, and suggestions for classroom use. Several students have put together their own Web pages with sites that they thought would be useful for themselves and other teachers. Two of the things that students find especially useful are the large number of subject specific annotated bibliographies and lesson plans by theme and grade level. Many of these materials would not be included in textbooks, or they would be found in several different textbooks.

There have been a few drawbacks and negative experiences using the Internet for the classes. Since many of my students have not used the Internet before, or have only limited experience they sometimes have problems navigating. In the beginning of the semester I get frequent questions about how to find specific assignments, I make changes to my Web page when several students have problems finding information. I make sure that they know that I am available to help them learn to use the Internet and encourage questions about its use. For both the new users and the more experienced ones as well sometimes they become frustrated when sites are busy or computers are unavailable. Luckily this hasn't been a major problem, and I make allowances for students who run into technical or hardware problems. I also have copies of assigned articles on disk that they can copy, as well as printed copies available in the library.

At the end of fall semester I had the students in my classes and students in another education class answer a survey that asked about their plans to use technology in their future classrooms, as well as their use of the Internet. I was surprised at the positive response from all the students about using technology, since in the past there has been a greater range of attitudes. One significant finding was that over 80% of the students owned their own computers, much higher than I've seen in the past. And about 50% had Internet connections from their computer. There were some complaints from students who either had inadequate Internet service providers or who lived in rural areas and had to pay long distance rates to connect to the Internet. When asked if the Internet was a good resource for the class, 22 of the 23 responding said yes, and one said maybe. Since some of the students, about 25%, responded positively to the statement that they would have preferred a book as a reference, this indicates to me that there was a high acceptance of the use of the Internet.

Web page: http://weber.u.washington.edu/~belinda/necc_lit.html

Literature for Children and Adolescents

Saint Martin's College ED 438/MED 538

Resource Sites

- The Children's Literature Web Guide
- Children's Literature: Fairrosa Cyber-Library
- Eric's Children's Literature Connection
- Kid's Publishing
- Media Literacy Online Article Database
- NCSS Notable Children's Books
- PBS Teacher Connex
- Reader's Theater Editions
- Storytelling Resources
- Young Reader's Choice Award

Books, Stories, and Poems

- Children's songs
- Dinotopia

- Eldrbarry's Raven Tales
- How the Leopard got his spots by Rudyard Kipling
- The Light Princess by George MacDonald
- The princess... (new fairy tales)
- Number the Stars by Lois Lowry
- The Page at Pooh Corner
- When Tillie Ate the Chili by Jack Prelutsky
- The Wright Brothers by Russell Freedman

Authors & Illustrators

- Children's Authors and Illustrators
- Madeline's Friends by Ludwig Bemelmans
- Eric Carle
- Lewis Carroll in Perspective
- Roald Dahl
- James Gurney
- Shel Silverstein

Lesson Materials

- Awakening Voices
- Banned Books Web site
- Bibliography
- Can Your Students Read TV?
- Cinderella stories
- I is not for Indian
- Ideas and Booktalk for Lostman's River
- Maurice Sendak's Dark Vision
- Native Americans in Picture Books
- Picture Books for Secondary Classes
- Poetry notes
- Pop-up Books
- History of children's books

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General Session: Exhibitor Presentation/New Curriculum Designs/Instructional Strategies

Intellitools Language Arts: Multisensory Language Arts Software for All Students

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Key Words: **adaptive technology, special education, disabilities, inclusion, curriculum adaptations, language arts**

Description of Session

Explore software encompassing letters and sounds, word building, sequencing, language development, and beginning writing strategies… accessible for students with physical, visual and cognitive disabilities.

Abstract

Computers can provide enhanced physical and cognitive access to learning materials for students with disabilities.

Technology adaptations have proven to be one of the most effective mediums for providing access for students with physical, visual or cognitive disabilities. The use of adaptive tools fosters independence and enables students to focus on the task and not the challenge of doing the task. However, most educational software requires students to use a mouse and a standard keyboard. Students with limited physical mobility or poor motor planning are unable to use a mouse. Other students are challenged by the complexity or layout of the standard keyboard. For these students, IntelliKeys®, IntelliTalk®, Overlay Maker®, ClickIt!®, and IntelliPics® from IntelliTools can provide customized hardware and software access solutions including access to popular educational software. In addition to issues of physical access, software-based curriculum materials offer students with disabilities unique learning advantages. By providing visual, auditory and kinesthetic learning, these students demonstrate greater skill mastery.

The IntelliKeys alternative keyboard can be used in a Mac or PC environment. Two switch ports allow users to interface with any switch software available. A set-up overlay makes it easy to adjust settings like keyboard response rate.

A student who has difficulty reading text independently can use the talking word processor, IntelliTalk. IntelliTalk reads and highlights every letter, word and/or sentence. Students interact with text in a multi-sensory environment. Teachers can create template materials that foster independent learning.

Entering text using letters, words or sentences is easily accomplished using the IntelliKeys keyboard and overlays created using Overlay Maker. Students learn language pattern by combining words on the overlay into sentences. Overlays that allow access to the curriculum can be a crucial part of curriculum adaptations.

Learning activities enhanced with graphics and text can be created in the multimedia program, IntelliPics. Activities can be customized a variety of graphics and can be accessible by mouse, IntelliKeys, and switch.

Ready-Made Solutions: Multisensory Language Arts Software

Helping students with disabilities improve their language arts and literacy skills is of primary importance to assistive technology specialists, therapists, teachers and families. IntelliTools has responded to this demand by creating high quality, ready-made, accessible curriculum solutions for language arts.

The newest activity in the Hands-On™ Concepts series is called Animal Habitats. These fully inclusive reading and writing activities are enhanced with creative extension activities that can engage all learners in the classroom. Skills reinforced in this integrative approach to language arts include story sequencing, descriptive writing, cause and effect relationships, comprehension and problem solving.

The I Can Write™ Strategy Series gives teachers a step-by-step method for teaching beginning writing skills using IntelliKeys, IntelliTalk, and Overlay Maker. This method consists of two approaches, writing letter by letter and word by word. Students learn to find specific letters on the keyboard, to read and type basic words made with these letters, and then to write simple stories using the same words. A set of ready-to-use overlay template files allows teachers to add their own letters, words and sentences.

Additional Internet Resources

The Alliance for Technology Access (ATA) is a network of community-based resource centers dedicated to providing information and support services to children and adults with disabilities, and increasing their use of standard, assistive, and information technologies. Centers can be found all across the country.

Web Page: http://www.ataccess.org

General Session: New Curriculum Designs/Instructional Strategies

Integrating Storytelling With Technology Into the Elementary Curriculum

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Key Words: **storytelling, heritage, language arts, computer publishing, portfolios, intergenerational, K–6 students**

Celebrating Our Heritage Through Storytelling

The key goal of "Celebrating Our Heritage Through Storytelling" is to create a new intergenerational curriculum in the primary grades which promotes the understanding of our heritage by linking the past and present through storytelling. The process of this technology-based innovation uses elders as storytellers in the classroom or through e-mail to provide a much needed opportunity for adults and students to interact on a very personal level. Primary students retell the stories they hear and have the opportunity to learn about the culture and the family values of an older generation.

The second goal is to improve literacy skills by stimulating students to be continually illustrating and writing their impressions of the elders' personal childhood stories. In this process, the stories are placed in a working portfolio to be edited and assessed through checklists and student-teacher conferences. The completed stories are collected in a showcase portfolio. Students select stories to be published using Kid Pix 2 and ClarisWorks 4.0 software on the computer. Each student will compile more than 30 stories which will be bound into a personal book.

Technology adds a new dimension to this project. The process of the third goal is for rural students and elders in a metropolitan area to connect by sharing stories through e-mail. Junior and senior high students record the stories told by the clients at an adult day care and e-mail them to us. A resident storyteller in our community shares the e-mailed stories with each class. Primary students retell the stories, computer publish them, and e-mail them back to the original storytellers.

Our fourth goal is to rediscover community elders as a valuable resource for learning in our school. This intergenerational exchange of stories enhances the self-esteem of the elders and provides the students with stories from diverse cultures. Children learn to communicate with and appreciate the wisdom our elder friends offer to them.

The students are assessed by their ability to recognize and record the similarities and differences in past and present generations. The academic growth is also measured by assessing the students' working portfolios of retold stories. Student/teacher conferences provide the opportunity to revise and edit the retold stories. Students read their stories to the teacher and use a checklist to evaluate their work. They are anxious to read their stories to other classmates and friends and take a personal pride in publishing their own book of stories. Significant gains in listening comprehension are measured by the transfer of information students are able to make from the stories they hear to other areas of our curriculum in science, social science, art, and music.

This storytelling project will be incorporated into the primary curriculum each year for a time span of eight months—September through April. The students participate in language arts instruction, technology training, scheduling storytellers, practice sessions with community storyteller, illustrating and retelling elders' stories, editing stories, publishing books, and preparing a culminating celebration with storytellers.

The impact of this project will be evident as students learn about their past and use present technology skills to illustrate and publish their retold stories. By continually retelling the elders' stories, the students become better writers and readers. A renewed interest is generated in education, as the community becomes involved in the curriculum.

The success of this project can be seen by the enthusiasm and involvement of the students, parents, elders, faculty, and citizens in the community. The students' final project, their published books, measures each student's academic growth and technology development . This project is already stimulating interest from other schools and communities because of the project's value and the ease of incorporating its replication into a K–12 curriculum.

Workshop

Internet K–2: Bulletin Boards for Discovery-Based Learning

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Key Words: **bulletin boards, discovery-based learning**

Is the Internet a tool for our "smallest surfers"? Can the student with minimal reading skills benefit from the resources on World Wide Web? How can teachers direct the young child toward appropriate student activities on the Internet? The participants in this hands-on workshop will decide as they interact with a teacher-made Web site, "Wee Web Meisters on the Net." The site was developed as a bulletin board for thematic, discovery-based learning in kindergarten through second grade classrooms. Participants will view a teacher-made Web site which was designed to support topics and content which appeal to the early elementary student and his teacher. Graphic links make it easy for the young Internet user to "surf" directly to selected URLs where the surfer can explore colors, stories, numbers, and games. The workshop emphasizes the utility of using a teacher-made Web site as a serious tool for channeling young children toward discovery of the net's most enticing sites. Participants will explore a teacher-made site, "Dinosaur Digging on the Net," a thematic Web, which allows students to explore the world of dinosaurs by linking to fossils, illustrations, excavation sites, and skeletal models housed in the world's finest museums.

A clear demonstration of the Web page planning process will be demonstrated using Inspiration software. Participants will "map" the links to be used in creating an original bulletin board for the young child. Exposure to outstanding educational resources will prove the Internet to be a valuable source of appropriate curricular content for the young child. Participants will use Macintosh computers and Adobe PageMill 2.0 to begin their own instructional bulletin boards. All participants will have hands-on opportunities to create a home page, add text, graphics, backgrounds, and links to remote sites. Participants will leave with concrete methods for using teacher-made Web sites as powerful avenues for discovery-based learning and a list of topically arranged URLs which are ready-made for the "wee" Web-meister and his techno-powered teacher!

Internet Poster Session

UtahLINK: Education's Connection to Excellence

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Key Words: **education, lesson plans, curriculum, instructional content, technology, education resources**

Abstract

Utah*LINK* is a service of the state-funded public and higher education consortium known as the Utah Education Network. Utah*LINK* provides Utah schools with Internet connectivity, software tools, comprehensive training and online access (http://www.uen.org/utahlink/) to electronic educational materials both locally and from the Internet. Utah*LINK* offers a variety of practical benefits to its users, who are students, administrators and teachers throughout Utah and the world. With more than 550 Utah schools connected to the Utah*LINK* network, more than ever, Utah teachers and students are tapping into the numerous educational benefits available on the Internet.

Content + Delivery + Support = Utah*LINK*. With this formula for success, online content plays a critical role in supporting and supplying educational resources to Utah. Through Utah*LINK*, educators have access to the "Curriculum Master database" which is a searchable, growing database built around the Utah Core Curriculum containing the state-adopted Course Descriptions, Standards and Objectives in content areas from Applied Technology to Social Studies. The database contains integrated curriculum units/lesson plans linked directly to Core content areas, as well as online projects/classroom collaboration listings, Electronic High School information, and links to content-related Web sites for teachers to view, download, and utilize in their classrooms. This project also includes a complete set of Utah Centennial Lesson Plans in honor of the Utah Centennial Celebration.

Through a partnership, Utah*LINK* provides statewide electronic access to full-text library journals—more than a thousand—and graphics in support of teachers, students, researchers, and citizens in Utah. Users may also view the Utah Collections Multimedia Encyclopedia, or participate in more than 25 different content-specific mailing lists to actively exchange ideas with others in the state.

For up-to-date information on all the great happenings at Utah*LINK*, check out the electronic newsletter LINKnews" at http://www.uen.org/utahlink/.

This presentation will share the design, development and publication of the Utah*LINK* integrated content resource site which focuses on lesson plans, state Core curriculum standards, collaborative projects, and educational Web sites. This Internet Poster session will allow participants the opportunity to view Utah*LINK*'s World Wide Web pages, experience the myriad of educational resources and databases included, and review the design and layout of the site.

Utah*LINK* is an evolving service whose focus is to enhance teaching and learning for students and teachers in Utah.

General Session: Society Session/New Curriculum Designs/Instructional Strategies
(Organized by ACM SIGCUE)

Electronic Reading Environments for Successful Studying

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Key Words: **hypermedia, electronic books, multimedia, electronic studying**

This presentation will describe and demonstrate the use of two types of electronic reading environments for the purposes of studying across the curriculum, CD-ROM books and WWW Study Sites. Both types of reading environments will be illustrated with currently available examples and handouts provided with lists of other products and WWW sites. Special emphasis will be placed on describing and illustrating the types of embedded resources and text enhancements we have found useful to students while using electronic reading environments for the purposes of studying. These include translational resources, illustrative resources, summarizing resources, instructional resources, enrichment resources, notational resources, collaborative resources and general purpose resources. Presenters will share the concept of "supported text," electronic text which has been enhanced with various types of resources designed to promote reading comprehension and improve content-area literacy. The presentation will conclude with recommendations for the future, including the development of design criteria for "universally accessible documents" and the creation of digital libraries of electronic reading materials with supportive resources designed to enhance the reading comprehension of K–12 students.

General Session: Technology Implementation/Educational Reform

Real Equal Access to Technology: The Out-of-School Component

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Key Words: **equal access, low-income students, TRIO programs, partnerships with business**

This session will present a range of projects of the National Council of Educational Opportunity Associations, and TRIO programs nationally, designed to assist low-income youth gain access to technology. It will emphasize projects that tap the potential of modern learning technologies,

particularly advanced telecommunications, to create more balanced learning communities for low-income youth. Particular stress will be placed upon the important role of out-of-school components including after-school and summer programs in this effort. A variety of university, library, and community-center based programs will be presented.

The Challenge

Modern learning technologies provide both an opportunity and additional obstacles for low-income and minority students. These technologies can be used to enable students isolated in rural or urban poverty to access high quality education programs not typically available to them. However, in most respects, these students are also disadvantaged with respect to their access to these modern learning technologies.

First, the schools they attend have less access to computers, cable television, LANs and modems than schools serving more advantaged students. Second, schools serving high percentages of low-income and minority students are less likely to utilize technology to teach higher order skills. Third, teachers and administrators in schools serving high percentages of low-income students often are troubled by such pressing problems that they cannot make use of technology their highest priority. A final problem must also be addressed. Low-income students are much less likely to have computers available to them at home. Since so many young people develop and perfect their skills with respect to technology in the home, equalizing in-school access alone, is not equalizing access.

The Vehicle

To help Americans from low-income families succeed in college, Congress established the federal TRIO Programs in 1965. The programs that form TRIO include Upward Bound, Talent Search, Student Support Services, Educational Opportunity Centers and the Ronald E. McNair Post-Baccalaureate Achievement Program. Currently, more than 1,900 TRIO Programs serve nearly 700,000 students. As mandated by Congress, two-thirds of the students served must come from families with incomes under $24,000 (family of four), where neither parent graduated from college.

Forty-two percent of TRIO students are White, 35% are African-American, 15% Hispanic, 4% are Native American and 4% are Asian-American. Sixteen thousand TRIO students are disabled.

Part of the Solution or Part of the Problem?

TRIO staffs realize that unless they assure that the instruction and counseling made available through their projects make full use of state-of-the-art technology, they can not adequately prepare the low-income students whom they are charged with serving for college. They also realize that, given their extensive out-of-school contact with students, they have a unique potential in equalizing access to technology as well as to impact partner schools. To sustain and improve educational opportunity program services, the majority of which are offered through the federally-funded TRIO Programs, NCEOA launched a series of initiatives over the past six years to improve access to technology for low-income students.

These initiatives have enabled thousands of students from low-income families to finally access computers, state-of-the-art multimedia computer technology and the Internet. In addition, many professionals in the TRIO Community (teachers, counselors and administrators) are now using this technology to develop new curricula, to improve various teaching, learning and academic advising activities for low-income students, and to network with educational opportunity program personnel nationwide

To move TRIO programs to a point where TRIO was part of the solution, NCEOA formed a Technology and Education Committee in 1990. The purpose of the task force was to:

1. disseminate information about technology;
2. work in conjunction with the U.S. Department of Education to promote the effective and efficient use of technology in TRIO Programs;
3. develop collaborations and partnerships with industry to provide technology and training to TRIO Personnel and programs;
4. seek out, establish and support training opportunities for TRIO personnel; and
5. serve as clearinghouse and as a leader in technology issues and resources for the entire TRIO Community.

Partnerships With Business

NCEOA recognized that to achieve full access to technology for low-income youth will requires major commitment from business. Microsoft Corporation recognized this need and launched a special partnership program four years ago that enables TRIO students to access state-of-the-art multimedia software. This partnership has provided the momentum for TRIO Programs to plunge into the use of multimedia. Today, thanks to the Microsoft/NCEOA partnership over 90 TRIO Programs have successfully installed software that exposes TRIO students as well as other low-income students in their partner middle and high schools to emerging technologies, including computer and CD-ROM applications and information access

As a result of the outreach activities of the Committee, NCEOA was also able to establish contact with Tele-Communications, Inc. (TCI). TCI sponsors training for TRIO staff members emphasizing the use of technology, including cable, to improve teaching and learning.

Impact on TRIO's Partner Schools

TRIO's pre-college programs, particularly Talent Search and Upward Bound, work with over 6,000 middle and high schools serving high concentrations of low-income and minority students. TRIO's impact on the use of technology in these schools has been significant. TRIO projects have, for example, been able to share software made available through businesses with these schools and provided technical assistance and support to teachers as they incorporate technology into their curricula. Moreover, TRIO programs oftentimes staff the after-school laboratories which provide more extensive access to computers for significant numbers of low-income students from those schools. TRIO students, first provided significant access to technology through Upward Bound or Talent Search, become resources to teachers and students in the schools they attend. Finally, through a special curriculum development project funded by the Department of Education, TRIO teachers develop curricula using Internet resources specifically designed for students from these groups.

General Session: New Curriculum Designs/Instructional Strategies

What Can These Machines Do? A Family Literacy Project

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Key Words: **family literacy, community literacy, community computing, adult education, early childhood education, teacher training**

Statements on Universal Design for Learning contributed by the staff of CAST

Identifying the Problem

Computers help a variety of learners obtain access to information and resources they would not otherwise have. Learners who are unable to turn the pages of a traditional book can have text digitized so they can navigate the text electronically. Learners with visual impairments can have text enlarged or they can have the color changed to meet their needs. Non-readers can have text read aloud to them. In this way, computers offer malleability of media and support for a variety of learning needs. Children who would have been labeled as ineducable in the past can be helped by technologies that provide supports they need to succeed educationally and occupationally.

The new information technologies also expand the number of skills children need. Expanding definitions of literacy are imbedded within our uses of technology and information processing systems. Traditional reading, writing and numerate literacies of the past will continue to be necessary. However, evidence also suggests that children will need additional literacies to gain access to the skills, information, and resources that will allow them to succeed as adults. The argument for a widening definition of basic literacy has been made so consistently and convincingly that it has become an accepted portion of schools' missions.

With all that in mind, how can we ensure that all students—regardless of ability or disability and regardless of their gender, race, or income—take advantage of the tools of the new literacy? Assuming that the tools of technology will magically eliminate the problems begs the question of whether technology will have a positive influence on learning and teaching. Putting any resource into schools does not ensure that the schools will know what to do with it, nor does it promise that the uses will affect all learners equitably.

Imagine a class session on how to use computers. Though all students receive the same lesson, some of the students have computers at home, and others do not. The children whose parents allow them to write reports, draw, or use the Internet maintain advantages over those who only have access at school. Children who perceive that "only 'smart kids' use computers" (or "rich kids" or "techie kids" or any group from which they feel excluded) are less likely to experience the power that computers offer. There are also differences in how schools implement computers. A school with a computer lab that students use periodically creates a different experience of computers than schools where each teacher has a computer and integrates it into lessons. A school's resources, training for teachers, the resources of parents, and children's affective reactions to technology all affect how children experience computers.

Universal Designing for Learners

In addition to these issues of equity are the equally significant problems of curricula and pedagogy that can exclude learners with disabilities. Printed text limits some learners because of its inflexibility. For example, learners whose disabilities make reading difficult or impossible (or those who cannot read the language of instruction) are limited by these difficulties. It would be wrong to assume that these learners will be magically helped by computers. Students who decode text poorly because of a reading disability will not perform better just because they are sitting in front of a computer screen. If computers and computer training are not equitable and accessible, then instead of helping, they can present barriers for some people. On the other hand, when technologies are designed with diverse learners in mind, these tools can provide the support and access that aid all learners. This capacity for universal access is key to the power that electronic technologies bring to learning.

Digital media is flexible and adaptable enough to meet a range of learners' needs. The ability to manipulate text, for example, offers opportunities for learners to interact with that text in ways that traditional written text cannot. In writing instruction, that has meant teachers can use word processing to reinforce the value of revision and editing—and the ability to manipulate text provides the supports that many disgraphic writers need to successfully gather, organize and express their ideas. Similarly, reading software provides readers with auditory and other sensory supports (e.g., changing text size and color) that adapt to their learning needs. That capacity makes digital media a valuable technology because it adjusts to a variety of learning needs.

The typical entrances to school buildings built more than 15 years ago provide an example of how technology can adapt to the needs of the people it serves. To reach one of these entrances, children climbed a short series of steps that led to the main door. While steps are an effective technology for getting into a building for some people, they represent a barrier for visually impaired or physically challenged people. More recently, in addition to steps, new schools all have ramps and/or elevators that allow every learner to have access. These more recently adopted technologies allow all people to have access, but they do more than just serve disabled people. Ramps and elevators allow multiple methods of access for everyone. In architecture, this concept of designing for special populations in ways that benefit all is called "universal design."

CAST (Center for Applied Special Technology), a not-for-profit educational research and development organization, applies universal design principles to the development of accessible learning technologies. Universally designed learning tools provide flexible supports so that learners with different needs, backgrounds, and interests can all succeed. New prototypes, teaching strategies, and software tools contribute to an evolving set of guidelines for universal design for learning. The current draft of CAST's guidelines includes three main areas in which flexibility and adjustability are essential:

- Multiple representations of information

  To provide access for all learners, reducing barriers for individuals with sensory and cognitive disabilities, information should be represented in multiple media (e.g. presented in both printed text and in spoken text), or in a medium which allows for easy transformation from one form of representation to another (e.g. digital text to synthetic speech).

- Multiple means of expression and control

  To support communication for all learners, and to reduce barriers for individuals with physical and expressive disabilities, software programs should offer alternative means of expression and control (e.g. recording in oral or written text, control through touch or voice).

- Multiple means of engagement

  To provide appropriate instruction for all learners, the level of support and the nature of the challenge should be individualizable by teachers and students.

  To increase utility and relevance for people from varied social, cultural, ethnic, linguistic and regional communities, instructional materials should be "half-full." That is, materials should provide core content and activities of general applicability, and also be designed so that teachers and students can modify content and activities or add their own (e.g. local images, sounds, text or recorded speech in different languages or dialects).

  (To learn more about these principles, please see CAST's Web site at www.cast.org and a forthcoming book, working title, *Universal Design for Learning)*

These universal design principles offer guidelines that release electronic media's potential to encourage learners to explore and create. A child who uses Kid Pix (a popular drawing program) learns to use computers to interact with and manipulate the on-screen world in ways that will reinforce the explorative and creative capabilities of computers. That child also learns to express ideas in visual form. In contrast, the child who uses computers only for drill-and-practice sessions, most likely learns that computers are not useful beyond routine tasks. A child who experiences the computer as a tool for exploration and creativity will develop a different relationship with it than the child who has no experience with computers or experiences them as tools of drudgery. A drawing program like Kid Pix can also help a student with limited fine motor skills express ideas visually in ways that would not be otherwise possible. Other programs help children – with various levels of ability and development – through the process of writing and reading. A variety of supports in computers can help learners create and express ideas, but teachers need to be trained in how best to use the power of computers.

Schools which serve low-income students or which have large numbers of disabled students have begun to reduce disparities in the numbers of computers they have available. However, these schools often implement computers in ways that limit students' perceptions of and access to the power of those technologies. As Henry Becker's research shows, though schools with high numbers of low-income children have reduced the disparities in numbers of computers available, they have not been as successful in getting their students to experience the high level uses that would allow students to become proficient explorers and creators with computers (Becker, Henry Jay. *Analysis and Trends of School Use of New Information Technologies*. U.S. Congress Office of Technology Assessment. March 1994). Much of the gain in numbers of computers used in urban and rural poor schools has come from federal funds which benefit students with learning disabilities. These funds are often used to purchase drill and practice software. This software can be useful in reinforcing skills, and it offers a start. However, it provides little opportunity for creativity or exploration with computers. Thus, students who could benefit the most from computers are excluded from using them in the way that would benefit them most. This gap threatens to exacerbate existing inequities as children from low-income households and children with disabilities become increasingly distanced from the technologies they need to succeed as adults.

There are, then, two problems which must be addressed to ensure that computers do not create further barriers for the learners they are intended to assist: The first is the issue of equity. If equity is defined as fair access to technology, then computers must be equitably available to all learners. Additionally, there must be, in the computers' design and implementation, consideration of how best to use the computers' potential for learners with disabilities and others who have been traditionally excluded.

Putting Universal Design Into Practice

For the past three years, CAST has piloted a project to address these issues. This project provides computer training and access for low-income parents who—because they do not have resources and/or education that would expose them to computers—would not have this opportunity. This training and access allows parents to use computers in ways that support their children's learning while increasing their own learning. The project is based in the belief that parents who model computer use provide the strongest incentive for children to learn to use computers. By creating a supportive environment for parents to learn about computers, the project also assists parents to develop the confidence they need to address their own deficiencies in both traditional and electronic literacy. Additionally, CAST has developed software and training that bring the power of computers into the learning process. This software and training emphasizes the ways in which computers and other technologies can help learners to master skills. In addition to training parents, the project trains primary grade and pre-school teachers training. By training parents and teachers together, the project creates opportunities for collaboration between parents and teachers.

Over its 12-year history of applied research and design, CAST has developed and adapted technologies to provide equitable educational opportunities for people with disabilities. CAST has learned that technology applications which meet the needs of disabled learners benefit all learners. This project is an extension of that work. In this project CAST is using the principles developed while working with disabled learners to meet a broader range of needs—for both disabled learners and other traditionally excluded populations. An example is Wiggleworks™, an early literacy software program which CAST developed with Scholastic, Inc. Wiggleworks™ has one function which reads text aloud to visually impaired students. That function also assists any students who need auditory supports for learning. It additionally reinforces all students' word recognition and pronunciation. Using this same perspective of developing applications that are universally designed to meet a broad range of learners' needs, CAST designed and implemented the Family and Community Literacy Project.

How It Works

The project began as a collaboration between CAST and North Shore Head Start in Beverly, MA. In the current project, 80% of the parents have not completed high school, and many have limited literacy which impacts their ability to nurture their children's emerging literacy. The director of North Shore Head Start estimates, based on her 23 years of experience working with Head Start parents, that 50% of the parents served by the agency struggled with undiagnosed learning disabilities in their own education. By improving parents' learning, the project addresses the intergenerational cycles of failure that create poor achievement and high drop out rates among these parents' children.

Parents and teachers attend training sessions together. They begin by learning to use pre-literacy and early literacy software and then progress to learning word processing. Starting parents with children's software has three important effects: Since this software is more easily mastered than most other programs, it provides an accessible entrance into learning about computers. Secondly, both parents and teachers find a value in this software since they can use it with children. The third benefit to beginning with literacy software is that it helps parents with low reading skills begin to address those deficiencies. In these ways, parents and teachers collaboratively learn to support children's reading literacy and computer skills, a combination that helps prepare children for the complex literacies of the 21st Century. Also, parents who have not been successful in their own learning have found success through the gradual increase in skills that they have gained. The project has additionally helped parents and teachers forge the school-to-home links that make parents and teachers partners in children's learning.

A recent participant in the project illustrates how this has worked. Alma speaks and reads Spanish, but little English. She has a 5-year-old daughter, Beatrice, who attends an elementary school which has been active in the project. Before the school year began, Alma and Beatrice visited the town library so they could find children's books and study them together at home in anticipation of the school year ahead. The librarian directed Alma to the computer catalogue where she could find books. She walked to the machine, realized that she was unable to use it, and quietly left. She was too embarrassed to ask for assistance.

At mid-year, Beatrice's kindergarten teacher enrolled in the Project training class to learn how she could use the Macintosh computer the school had purchased for her. The teachers from this school have traditionally brought at least one parent along. This teacher brought Alma. In all of the sessions, the teacher and Alma sat beside each other, and they learned together. During some sessions, Beatrice sat with them. Over the course of the training, Alma began to use the computer with more confidence, and when Beatrice came to training sessions, Alma explained her new-found skills to her daughter.

By the end of the school year, Beatrice and Alma began to make regular trips to the library. Since she no longer felt threatened by computers, Alma extended the confidence she learned from training into another experience which created the potential for even more learning. Alma now provides the kind of modeling which encourages Beatrice to explore new experiences and opportunities. At school, Beatrice's teacher uses the techniques she learned during training to provide Beatrice with additional exposure to computers. Beatrice regularly uses the computer in her classroom to learn how to read, write and manipulate images on-screen. She is taking the first steps toward being the type of multi-literate learner who can navigate the levels of knowledge and resources she will later need to master. She also shares her knowledge of computers with other students in class. Beatrice has become a leader in her class when all prior indications show she most likely would have experienced computers as a barrier to her learning.

Present and Future Directions for the Project

Initially, CAST staff trained parents and teachers in the CAST computer lab. This year, they have received a grant from the Hasbro Children's Foundation, The Children's Trust Fund, Richard Robinson and Helen Benham Charitable Trust, the Alden Trust, and the Taft Trust funds a Family Learning Center in Salem, MA. In addition to training, the Family Learning Center is open for parents and children to drop in for unstructured access to the technology that parents learn to use during training. This access includes use of available software and the World Wide Web. The creation of a community-run center is critical to the future success of this project. Community-operated and controlled centers provide the clearest chance to maintain and build upon the success of this project. The current funding provides for a community coordinator who will contact additional parents in the community who can benefit from the center. Additionally, this staff member forges links with other agencies to ensure articulation of services for parents who visit the center. The center also relies on volunteers to provide ongoing staffing and peer training to parents in the community.

In developing this project further, CAST builds on factors that supported the project's early success. The most practical factor is Head Start's built-in capacity for reaching new audiences. Each year, a new group of children and their parents enter Head Start, while another enters primary school. Equally important is Head Start's family-centeredness: Head Start views the support, development, and empowerment of parents as integral to its mission. To meet that goal, North Shore Head Start creates a safe, supportive and nurturing environment for parents who may lack the confidence they need to become advocates for themselves or their children. In addition to the CAST training, Head Start provides other family-centered services such as career and educational counseling. It also offers parents practical supports such as transportation to classes.

While all these reasons make Head Start programs ideal for replication of this project, CAST believes that this model will work in other types of agencies as well. Therefore, in addition to the existing program, CAST is developing additional partnerships. CAST will train and support these partners in creating Family Learning Centers at their locations. Using the model developed at the North Shore Head Start Center, each Center will provide computer access and training to adults and children who might not otherwise have that access. These Centers will provide this within the context of helping parents and teachers use computers and other technologies to support children's learning

CAST will demonstrate the project at three additional sites: One in Cambridge, Massachusetts, and two remote to the greater Boston area. The Cambridge site (Cambridge Community Television, a local public access cable provider) is developing replication methods for agencies outside of Head Start. The remote sites will participate in developing replication methods for sites not in close proximity to CAST. CAST staff will support the urban Boston site through on-site training, consultations and telecommunications. The long-distance replication sites will receive initial, on-site training and ongoing telecommunications consultation. Training and consultation for the Cambridge site began in January of 1997, and the other two sites will begin their participation in September of 1997. These demonstration sites provide the foundation of an Internet-based national network of these projects.

Preliminary Results

Although the pilot phase of the project was not formally evaluated, the following information suggests that this project has been successful:

- Twenty-six parents participated in the training during the first three years.
- Of the first and second year groups, only two of 12 parents were enrolled in formal education when they began classes. To date, five others have enrolled in adult education or community college classes. One of the five has completed an associate of arts degree in computer applications and is working for a local school system, and the other has completed a certification in early childhood education and works for North Shore Head Start.
- Over the three years, seven parents have volunteered in the project as peer tutors and/or bilingual translators after their initial training.
- Fifty elementary (K–3) and pre-school teachers were trained over the three-year period. The 50 teachers each are implementing the tools they developed with 20 to 25 students each year. Over the three-year period, that translates into 1,000 to 1,250 students being taught with the methods that teachers learned in training or during consultation.

Evaluation of the Model

In the first year of the project, five parents participated. In the second year, seven more parents attended training. In the third year, that number increased to 14, and this year, the Salem Center has a waiting list of 60 parents and 30 teachers wanting training. That increased participation suggests that this project meets a need. During the next two years of the project, CAST has established a formal evaluation protocol to measure the project's impact.

Hypothesis

This project assumes that adults who become successful learners will model the learning that foster success in their children. It moreover assumes that parents will, in the process of learning how to use early and pre-literacy software, learn ways to support their children's emerging literacy. By coupling this training of parents with the training of teachers, the project encourages collaborations between parents and teachers.

Therefore, the evaluation will test the hypothesis that all of these factors are necessary to support children's ability to gain the complex literacies they need for educational and future occupational success.

Methods

The evaluation of the hypothesis consists of two levels: program evaluation and a study of participants' experiences. The program evaluation uses quantitative analysis, while the study of participants' experiences uses qualitative methods. These complementary methods provide a glimpse into the complex context of participants lives, while identifying how the program impacts the people it serves.

All the people who enroll in training (from all four sites) participate in the quantitative analysis of the project. Each person completes a pre-study and post-study attitudes questionnaire (using Likert-type scales) to measure changes in affective responses to computers. Also, CAST researchers complete pre-study and post-study formal surveys of skills to identify what skills that participants gain during training sessions.

A carefully selected sampling, as with any other study, provides useful results while providing efficient use of resources. Therefore, we conduct the qualitative segment of the project selectively. Ten parents or teachers participate in ongoing video ethnographies of their computer experiences to discover how they use and perceive the technologies they learn. Unlike quantitative methods, which rely on numbers of participants to achieve a representative sampling, the low numbers of participants allow for in-depth qualitative analyses of each participant's experience.

A preliminary project report will be available in June of 1997, and a final report will be ready in June of 1998. The report will be available on the Internet at www.cast.org.

General Session: New Curriculum Designs/Instructional Strategies

Eliminating the "Qualification Gap" Between Multimedia Education and Industry

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Key Words: **multimedia, education, industry, skill standards**

Abstract

This paper describes the efforts of an instructor/curriculum developer to translate industry needs into multimedia curriculum using skill standards developed by the Northwest Center for Emerging Technologies. First, the Skills Standards for Information Technology project is described, focusing on skill standards developed for the career cluster of Interactive Digital Media Specialist. Next the paper describes the author's efforts to integrate such skills standards into the teaching of multimedia courses at two different institutions of higher education.

General Session: Technology Implementation/Educational Reform

The Plug Project—Integrating Technology Into the Elementary Curriculum

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Key Words: **elementary, curriculum integration, PLUG, reform**

In the Calcasieu Parish School System, in southwest Louisiana, the Technology Training Center staff teaches teachers to use computers. The teachers return to their classrooms knowing hardware and software basics, but not knowing enough about how to use technology effectively with their students.

Over the years, the Tech Center staff has tried to provide experiences that would put classroom technology in context: school visitations, working with mentors, pairing teachers as keypals on a local BBS, and grouping teachers by grade level with a master teacher. Still, teachers looked for quick, easy, technology plug-ins to simplify daily lesson planning.

A small grant provided funding to employ a group of eight master technology-using teachers in the elementary grades to meet in the summer to talk about these curriculum plug-ins. In its early sessions the team worked on a definition of technology and a philosophy of its use. After coming to a consensus about the scope of their task, they decided to poll exemplary teachers to see what form the plug-ins might take.

The team sought input from hundreds of educators in the 36 elementary schools in the system. They complied the ideas into a 200 page document which they dubbed "The Plug." It organizes the elementary curriculum by theme, strand, and grade level, and provides activities, resources, diagrams, tips, and tricks for daily use in a classroom.

This NECC session describes the process of implementing The Plug philosophy: writing the document, supplying enabling tool software to 250 participants, modeling lessons to representatives at all grade levels in all elementary schools, evaluation, and revision of the project.

Significant, transferable lessons were learned when implementing the project. Some are:

- teachers should be good teachers first, technology users second;
- to cause systemic change, seek input from the educators to be impacted;
- allow for multiple levels of entry into the change process;
- deliver complete solutions.

Attendees may download the entire text of The Plug from the following URL: <http://hal.calc.k12.la.us/~techctr/ThePlug.html>

General Session: New Organizational Structures

Innovative Teachers in Remote Places: Professional Development in the Vanguard for Learning

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Key Words: **professional development, rural schools, DoDDS, telecommunications**

Professional Development in Small Remote Schools

How can a school system support innovative practices and professional development of teachers who work in small schools, geographically isolated from each other? How might such a school system make the transition from the traditional model of summer workshops away from their worksite, to supporting teachers in an ongoing way at their own schools? In what ways can computer networks and telecommunications help?

The U.S. Department of Defense Dependent Schools serve about 80,000 children in 200 schools on military bases around the world. Traditionally, new curricula and teaching practices are adopted at the central headquarters and implemented worldwide through summer workshop training which teachers travel long distances to attend. Like many school systems today, the DoDDS system is moving towards site-based management, local School Improvement Plans, system-wide implementation of technology across the curriculum, and support for locally initiated innovation. Such shifts demand a radically different model of professional development, one which supports teachers throughout the school year in the context of their everyday work.

Vanguard for Learning

The Vanguard for Learning project, sponsored by the National Science Foundation and the Department of Defense Education Activity (DoDEA), is helping DoDDS schools in Aviano, Italy build their local capacity for initiating, implementing, and researching innovative practices in teaching, assessing student learning, and involving parents in the school. Vanguard is studying the costs and effectiveness of different professional development approaches. During 1996–97, teachers in Aviano were offered (by DoDDS and Vanguard) 35 kinds of resources and professional development opportunities, from traditional summer workshops in the U.S., to a telecommunications-based graduate credit course, to onsite work sessions with colleagues, to ongoing mentorship with U.S.-based researchers. Of these resources, direct personal assistance onsite was reported by teachers to be the most useful type of resource. Effectiveness of professional development via telecommunications evolved with equipment and infrastructure improvements. Printed materials and videos were used by very few people.

Multiple Perspectives on a Changing Culture

This General Session panel provides multiple perspectives on teachers' experiences in Aviano. Ruthmary Cradler describes the Team Action Plan model. Peggy Kelly, CSU San Marcos professor of teacher education describes interactions with teachers in online courses from the professor's point of view. Nancy Tsekos, high school teacher in Aviano describes progress and challenges her fellow faculty are confronting as they build teamwork, use remote online resources for professional development, and become more reflective practitioners. Marilyn Tarratoris, teacher in Vicenza, Italy, describes the promise and pitfalls of team teaching with a colleague and students at a distant school, and professional development opportunities such teaming offers. Diane Anderson, elementary teacher, describes working with remote mentors and with local colleagues on innovations in teaching.

Traditional Poster Session

What Are You Doing With Technology at Your School?

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Key Words: **professional development, technology, School Transformation Plan**

"Just out of curiosity... What Are You Doing With Technology at Your School?" was a question posed to Jefferson County Public School principals in an effort to highlight school technology programs with strong administrator role models. Responses included items from several of the following areas:

- How is technology included in the School Transformation Plan?
- Where are computers physically placed in the school?
- What instructional role does technology play in the school?
- How are the competencies on the JCPS Technology Skills Continuum treated in the curriculum?
- How are personnel and time allocated to meet this challenge?
- In what ways have the technological skill of faculty and staff members been improved?
- How have parents and the business community been involved in making technology a strong part of the instructional program?

To encourage feedback, JCPS offered some exceptional prizes which were donated by a corporate sponsor—13 teacher presentation sets, composed of a projection panel, an overhead and a professional development session on effective instructional uses of computer projection equipment. A group of retired principals, present administrators, and teachers designed evaluation criteria for judging the various proposals.

This district-supported effort was designed to encourage increased incorporation of technology into the curriculum. Strong programs and their leaders were identified. The highlights of successful programs are:

- A clearly stated technology component in the STP (School Transformation Plan).
- An ACTIVE technology committee with a budget.
- Professional development funds earmarked for technology.
- A plan for including the Computer Applications Skills Continuum within the curriculum.
- E-mail availability.
- Knowledge of and use of district resources.
- Participation in technology conferences by administration, staff, & students.
- Evidence of business/parent involvement.
- Instructional use of the Internet.
- Evidence of administrative use of technology—Personal Productivity of technology into the curriculum.

The ultimate goal for the project is to share these successful methods and strategies with current principals, site-based decision-making councils, and those individuals who are in preparation for administrative assignments.

Visitors to this session will be presented with exemplary examples of technology use in schools and the building-level leadership which encourages and sustains it.

Related files for this project will be posted in both Macintosh and Windows format at:

http://www.jefferson.k12.ky.us/edtechstaff/CESstaff/JimD.html

General Session: Technology Implementation/Educational Reform

Power Thinking Through Science and Technology

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Key Words: **elementary, science, technology, girls, community, staff development**

Power Thinking Through Science and Technology enables children to raise questions and provides opportunities to conduct research, relating information back to the question that motivated them initially, and communicate the results. Through this grant, we have designed a child-centered Science Discovery Center. The center is multi functional. It is a lab where Alvarado students seek information independently and a vehicle where students can showcase their understanding through exhibits and experiments. Included in the Discovery Center is the use of technology. Additionally, since most of our students do not have access to information technology in their homes, our after school Computer Academy provides students with opportunities to become experts in the use of computers and the Internet. One section of the Computer Academy is only for girls so as to develop increased participation of this group. The Computer Academy has developed interactive multimedia projects to be shared with the school site, the community library, and on the World Wide Web.

The Union City Public Library received one computer from Alvarado Elementary to station in their library. Patrons are able to access the Alvarado Elementary Home page on the World Wide Web which provides information about the school's activities, such as classroom sites, Alvarado Cyber Explorers (ACE), a Native American Web site for children and other pertinent school information. Since the library is already connected to the Internet, Alvarado Elementary students are able to conduct research, and patrons will be able to correspond with our students through e-mail. The library has agreed to extend our partnership to include storytelling at our school site which will be broadcast throughout our school using our Synergy Hub system.

The Lawrence Hall of Science has conducted workshops for families, teachers, and students such as the Bubble, Health, and Earth Day Festivals. These programs provided active learning experiences for all students. These have also enabled us to provide a comfortable atmosphere where students played and experimented with important mathematical and science ideas.

Parents and other community members have participated in our program in a variety of ways. They have attended meetings to plan and create our Discovery Center. They have shown their support by volunteering during California's Net Day and National Net Day '96 and at the Lawrence Hall of Science festivals.

Due to the passage of a $55 million technology bond, we have fiber optic wiring for our computers and cable television. ISDN wiring enables us to add virtual reality field trips to our classrooms. By linking to the World Wide Web we increase student resources to include science resources beyond the physical confines of the classroom and school.

Our district has shown a commitment to the implementation of technology by providing all staff members with weekly inservices. These "Tech. Wednesdays" create avenues for staff expertise in the use of our technological equipment and current software allowing Alvarado Elementary to travel on the Road Ahead into the 21st century.

Spotlight Speaker

It's Not the Internet, It's the Information: Net Savvy for the Information Highway

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Key Words: **Internet facts, e-mail, cyberspace, technology shortcomings, intellectual laziness**

Who is this guy?

- what is he going to do?
- overview of Internet from different perspective
- present and future of Internet for schools
- outline information literacy curriculum

The Internet Revolution: Do you remember when?

- you didn't see gee whiz articles about the Internet in magazines and newspapers
- surfing was done outdoors
- Java was something you drank
- the Web was a TV or a phone
- you didn't see "http://" written at the bottom of ads
- you didn't have to explain the @ sign
- how long ago was that? 19 months
- it has been there for some time, but it's been flying below our personal radar

It's spreading like wildfire

- become the infrastructure for every company and industry in marketplace
- although many just don't know it
- world's largest economic sector
- an import surpassing oil and steel
- driving fundamental changes in business and community
- new reality for 21st Century

What's happening?

- explosion in summer of 1995
- went overnight from geekhood to coolness
- from a special thing done by a small priesthood to public consciousness overnight
- abolished distance making everywhere here
- in '94 there were no commercial Web sites
- now they number in 6 figures

- everyone's registering domains
- Yahoo gets 3,000 plus submissions daily
- Web doubling every 53 days
- this is biological growth—like red tide/lemmings

The e-mail explosion

- 30 million messages daily
- the equivalent of $9 million worth of first class mail
- total volume by Post Office is up 5% since '88
- but business mail is down by 33% in same period
- only stuff that goes through is at-risk mail
- post office has become one giant piece of road kill on information highway

What *is* happening?

- cyberspace now middle class suburb
- this has happened in a world of $2,500 computers where using telecommunications is like trying to suck peanut butter up a straw

What *will* happen?

- when we see $500 network computers combined with @Home cable modem at 10,000,000 bps
- will the number of users go up, down, or stay same?
- obviously it'll go up—this in part explains Internet fever and the rapid stock market

Where are we heading?

- we ain't there yet...
- still hearing lots of criticism
- there are lots of problems related to slowness, security, under/over regulation, and potential overload
- this shouldn't concern us as eventually Net will handle them—but this takes time
- but despite problems, a critical mass has been reached—we must acknowledge the sheer magnitude of an expanding base of true believers

Nothing but Net

- there is controversy over how many regular users there are but no controversy about the fact that the Internet is coming at us like tidal a wave
- it's hard to exaggerate importance
- it's opening communications to masses and quickly racing toward full-fledged status as commercial medium

So What About Schools?

- is it really a technological revolution?
- since late 70's, billions of dollars and words have been spent
- in the 1995/96 academic year alone, tech spending in K–12 public schools was $4 billion—twice the amount spent on textbooks

So what's the problem?

- we have endured years of hype and hope for electronic education, most of which has been undertaken with the very best of intentions

- unfortunately, the primary focus has been on tool and hardware du jour
- as a result, the revolution is still not here—why?
- we primarily focused on the tool not the application of the tool to curriculum
- we can't blame a pencil if a child can't read or do math—and we can't blame the technology for failing
- the problem lies mainly with curriculum and teaching strategies
- so how does this relate to the Internet?
- it's déjà vu all over again!

What about the Internet?

- 90% of classrooms in America today don't have access
- beyond that, classrooms are limited by the available equipment as only 12% of computers in schools today are capable of Graphical User Interface access to the Internet
- 35–50% of schools have *some* access but this is usually a single station located in a classroom, the office or the library
- this is like having a single pencil for the entire school and expecting everyone to become pencil literate

Where are we heading?

- only 9% of classes have access (which is up from 3% in 1994) but this will change quickly based on trends about Internet access outside of education
- but based on the trends outside of schools, let's extrapolate
- 5 years from now—do you think that there will be more, less, or the same level of access for students?

So what's the problem then?

- it's not about access—this will happen
- very few doubt the power and potential of age-appropriate tech to transform education
- the problem won't be access to computers or the Internet
- no—the real problem is about the focus

What's wrong?

- instructional technology holds enormous potential for instruction and learning allowing access for *any* student in *their* native language to a world that they are very comfortable with
- it provides opportunities to take digital field trips and access to world-wide resources
- this isn't the problem—it's the mindset that we're applying to the technology
- we need to prepare for this new world—and we need a new mindset that focuses on a new curriculum and new teaching strategies

How is it being used today?

- for most we use a proximal learning model—we put students close to the technology and hope or assume that somehow they will learn by osmosis—unfortunately, more often than not this does not happen
- the problem is that kids know more than teachers so the kids define the context and content
- so where do *they* go? to Wrestlemania, the Scooby Doo home page, the NBA online, to live chat lines and to the Doom home page

So what's the problem?

- most schools today are little more than ISPs because students and teachers are using Internet services without an instructional context
- we have to ask whether this new media to be used for higher level learning or will it just become a new generation of educational Nintendo?

What skills are needed?

- skills needed to effectively utilize Internet are little different than those used in a library—the only difference is that we have new technology, but despite this, we're applying an old mindset
- whatever the medium, users need a set of analytical skills to process this information—but schools have never *really* mastered teaching of information literacy

It's not the tool, it's the task

- tools have no meaning without context—if I give you a shovel, you have no idea what the context is—but if I give you a shovel and tell you to dig a ditch, it has a context
- the Internet is a great tool, but for what?
- and this the crux of the problem—many teachers just give students the Internet and then get out of the way
- this is a case of leap of faith, proximal learning!
- as a result, we are simply replicating old problems and processes with new technology—now we get animated, full color meaningless, gratuitous information more quickly—this is *not* learning!
- for learning to take place, it must do so inside a context

The problem transcends technology

- in the past, we gave kids an assignment on Saturn and got back the Encyclopedia Britannica
- along came optical disc technology—we gave kids an assignment on Saturn and got back the Grolier's Multimedia Encyclopedia
- now we give kids an assignment on Saturn and we get back the Internet
- this is simply information bulimia—they suck up the information and spit it out with little consideration of what it means—as a result, many of our students are suffering from intellectual and informational anorexia
- schools think that if they're connected, they're doing it

What's wrong?

- instructional technology and Internet are being used to gather raw data but much of the writing and research is garbage
- information is not knowledge; and computer literacy doesn't necessarily cultivate information literacy
- it appears that the Internet breeds a kind of intellectual laziness
- the ability to find and list data is no substitute for figuring out how to organize information
- as a consequence, even in schools with full connections students can surf the Net but can't move beyond visiting home pages

Geraldoization of information

- the Internet is a wasteland of unedited data without any pretense of completeness—it lacks editors, reviewers, and critics—as a consequence it is predominantly not information, but noise
- the problem is that this is not recognized by most students and teachers
- this is the crux of problem—people have not been able to get beyond oohing and aahing about sites and suffering from terminal technodrool
- as a consequence, we really need to shift gears... because it's not the Internet, it's the information that's important

What is needed?

- people need more than just raw data—they must look beyond the data for significance
- what skills are needed to see significance of data?

An example

- the Captain Picard model of problem solving
- how and when does he use technology?
- only when he has a task to do
- he asks a question of the computer based on a problem
- access to technology is transparent
- he then analyzes the data retrieved and turns it into knowledge
- then applies the knowledge to solve the problem
- then assesses process he has undertaken

5 Stages of Information Literacy

- Ask
- Access
- Analyze
- Apply
- Assess

Stage 1—Ask

- comes out of a problem
- if you don't have a problem, you don't have a question
- at this stage you are defining problem
- problem solving fosters ownership of learning

Stage 2—Access

- strategies more important than tools
- use driven by context created by questions
- searching techniques used to locate information
- techniques are *media independent*

Stage 3—Analyze

- how credible is the information
- need to use the tripod model of analyzing—the stool won't stand unless it has 3 legs so the information can't be trusted unless there are 3 corroborating sources
- students must be able to look at information critically

Stage 4—Apply

- use information to solve problem, write essay, do report, create graph, complete argument, make presentations
- at this stage, you must take what you've got and create products
- need to submit both raw material and analysis
- access is nothing if you can't both analyze and apply what you have obtained—to do this you need both technical and conceptual skills

Stage 5—Assess

- have original goals been met?
- what has been learned?
- not just *what* has been learned but also *how* it was learned?
- how could process or product be improved?

This is what the Internet needs to be about!

Information literacy

- transcends Internet
- applies equally well to magazines, newspapers, textbooks, CD-ROMs
- it's not the tool, it's the task
- it's an issue of headware not hardware

It's not the Internet, it's the information

- what we have is data explosion not knowledge explosion
- we have the best educated, least prepared generation
- we need the tools but we can't stop there
- we need repeated opportunities within formal, structured informational context

Achieving information literacy

- students need to work with the information resources that will bombard them throughout life
- this is not just about the ability to read and regurgitate facts—it's about knowing where to find facts and then how to use them
- it's about using real-life information resources for solving real-world problems
- my greatest fear is that if students view and use the Internet the way they view and use encyclopedias and CD-ROMs, we will continue to get what we've always got

It's time to shift gears

- we must move students and teachers from a quantitative to qualitative mindset
- it's not how much information they have, it's how much knowledge they've gained

Making the shift

- the bottom line is that it's not what you use but how you use it

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Workshop

Shifting Gears—Content to Process: The Key to 21st Century Curriculum

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Key Words: **information overload, technology impact on society, informational dysfunction**

By now, most people have realized that the world is no longer the stable and predictable place that it once was. But just how fast is the world moving. There are many who are saying that the changes in the next 10 years will dwarf those of the last 50. What impact will this changing world have on education? And how can educators plan effective curriculum in an environment of accelerating change?

This presentation examines some of the **major new technologies** that will fundamentally change the world in the next 10 years, explores the shift in curriculum and thinking that will be necessary to equip students for success in the brave new world of the 21st century, and identifies what this signifies for communities. How can schools prepare students for this world? Perhaps by focusing less on technology and more on processes, information and new mindsets for those preparing for the workplace.

Then consider the profile of the skills that will be needed by 21st century workers employed in information based jobs. Then think of the profile of skills that students leave school with today. The contrast between the two is shocking! Active involvement vs. passive reception, problem solving vs. memorization, owned responsibility for learning vs. deferred responsibility to others, proactive projection and planning vs. reactive short-sightedness, the use of technology as a powerful tool for accomplishing tasks vs. use of technology as an end in itself.

In short, focusing on the processes of learning and problem solving where students are viewed as fires to be kindled vs. focusing on specific content where students are viewed as vessels to be filled. The environment of accelerating change due to technological development creates disposable information, quite unlike the relatively stable information of the Industrial Age.

When you add to this incredible mix the emerging interplay between the **Internet** and wired and wireless technologies, you have a recipe for major informational disaster. The sheer magnitude of resources accessible to the masses is simply beyond our imagination. But just because there is a ton of information available out there doesn't mean that we are any the wiser for it. In fact, this flood of data is creating serious overload and leading to overwhelming **informational dysfunction** amongst adults and children alike. The challenge for educators is developing curriculum that has validity in this environment of change.

This presentation looks at the forces at work in the world today that are causing this major shift in our approach towards education, outlines an instructional model that will equip students with essential **process skills** that will last a lifetime; and explores the notion of progressive withdrawal as a fundamental principle for curriculum design.

It then outlines a set of powerful **information literacy tools and strategies** that can be used to provide fast, fast relief for all forms of informational indigestion.

Participants should come prepared to have all of their assumptions about information and information literacy challenged. Hard hats will be provided.

General Session: Technology Implementation/Educational Reform

The Electronic School

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Key Words: **distance education, educational reform, virtual learning, business partnerships**

Abstract

The Electronic School will provide a World class education for all students and the School will be any place, anytime, and for everyone. The Electronic School is a virtual school accessed over the Internet and supported by content and strategies provided via instructional television, videos, CD-ROM, and the Instructional Technology Centers, providing equal access for all students. It also offers creative and unique opportunities to change the face of public education by incorporating new instructional strategies for disseminating information and promoting interactive multimedia as an instructional component.

The Electronic School project will support educational reform in Hawaii by increasing access to learning technologies for students and parents at more convenient times and more accessible places. Our vision transforms the traditional school model into virtual learning centers utilizing the Internet and other telecommunication systems. To improve student achievement, these centers will provide curriculum which will be aligned with state and national frameworks and performance standards. This will be accomplished while integrating thematic content with real world problem solving strategies. The Electronic School will both extend the traditional school

schedule and expand awareness by including experiences from the community and the world. Over the five years of the grant, approximately 183,000 students from Hawaii and 407,000 students from Chicago will have access to the Electronic School.

Our vision for systemic reform empowers students to use information technologies to develop marketable skills and to heighten creative and critical thinking faculties. Additionally, this Electronic School model will allow all members of the community to participate in the educational process. It will be seamless and the technologies will be transparent. Computers will be in every classroom and accessible to all students either at regional centers or by being on loan to families. Some courses will be taught in a traditional setting, others over the Internet. Core and elective courses will be available on campus, from home, business, and/or community centers. Everyone will be involved in some fashion; parents, teachers, and community members will facilitate, instruct, organize and mentor the Electronic School students.

This model truly reflects the African adage that it takes a whole village to raise a child. In fact, due to the expansive nature of the Internet, students will be able to access not only their local community, but will be connected with learners from around the world.

The HSDOE began The Electronic School in September 1996 with direct services to students statewide. Five new courses developed in July 1996 were offered in Phase One of the Electronic School. The courses are Shakespeare Online, AP US History, AP Computer Science, Global Studies and Geometry. These courses will be offered for all students grades 7 though 12 in Hawaii. These courses will then be enhanced with project funding to extend the courses by developing CD-ROM support and video enhancement of each course. The HSDOE has already piloted two courses in the Spring of 1996, Telecommunications and Advanced Guidance, both of which have been very successful.

The Hawaii State Department of Education, in collaboration with Tech Corps Hawaii (with more than 150 founding members), is developing comprehensive programs that combine innovative technology initiatives to raise the achievement of underchallenged and at-risk students (and their families). The Electronic School will be a successful model as it already has created multiple partnerships within the wider community. More than 150 corporations and educational programs have pledged their support in building this virtual school. This support ranges from extended connectivity being provided to schools, teacher training, mentoring students, to providing technical expertise in the areas of multimedia development. The Electronic School's Advisory Board is composed of professional, business and education executives who will provide guidance and quality control.

Spotlight Session

The Teacher as Actor: Keeping the Visuals, Vocals, and Verbals Alive in the Technological Environment

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Key Words: **teaching dynamics, positive use of technology, teacher's presence vs. technology, misuse of technology**

Technology, no matter how rudimentary, has long been a valuable teaching aid when used correctly. In the past, teachers have been excited about the opaque projector, the 1/2" VCR and monitor, the cassette tape, the overhead projector, and NOW the computer. With the introduction of each new technological device, good teachers have discovered that how they teach and what they teach can be either enhanced by the technology or become a distraction and hence, the acquisition of the knowledge is not as high.

Currently, the good teacher still supplies much of the stimuli and motivation leading students to learn. Understanding the power of one's visual, vocal, and verbal communication, (the 3 V's), can lead to more energetic, enthusiastic, and exciting, (the 3 E's), classrooms and learning acquisition. Considering that some research states that as much as 80% of a teacher's communication with the students is via his/her VISUALS, (Non-verbal), the impact of using positive visuals in communicating with students cannot be overlooked. As well, the VOCALS, (Vocal Qualities), play an important role in passing to students the teacher's passion and importance of what is being presented and learned. Research shows that the VERBALS, (actual words spoken), are not nearly as important as how the teacher visually and vocally portrays the words.

So, how does the use of technology, especially computers, change this dynamic. First, it should not change this dynamic drastically. Until computers can actually duplicate the human voice in a "tolerable" manner, using all the vocal qualities available to the human being, as well as convey emotion, passion and importance, the teacher still needs to be aware of the 3 V's. However, the teacher may find himself/herself in more of a facilitator's role rather than the "sage on the stage" role and that can lead teachers to become less effective communicators to their students. They actually begin to communicate less-and-less visually and vocally, believing that the machines themselves will motivate the students for an entire class period.

Secondly, all use of technology should have as its foundation for use, the enhancement of the instruction and learning, NOT the total lesson itself. Even with the games, the pizzazz, the color, the animation, available with current computers, research indicates that student's attention span is about the same with or without the technology: about 13 minutes in adolescents. Student evaluations show a preference for a mix of technology with the "live" teacher. Thus, the teacher utilizing technology should not see those days as "free" days. A case in point: videos are used profusely in schools but the normal procedure is for the bell to ring, the teacher pushes "ON" and sits until pushing "OFF" just before the end of the class. Any discussion of the film follows the viewing in its entirety. Where is the accountability? How many valuable concepts have been missed with a single discussion at the end?

Technology usually limits the teachers movement about the classroom. So, research finds that 68% of all teacher's movement is in the "footlight parade"—a path back and forth in front of the class. The "inland passage" and "great preambulation" are seldom utilized, leaving those students anywhere but the front feeling left out, isolated, or else they "hide"! With cords, outlets, large tables, etc. the good teacher will figure an appropriate path to all the students so they all get the indication the teacher is genuinely interested in their progress and learning.

With every new invention, there have been fears that "this one" will truly be the ruination of civilization! And, yet, here we are survivors of the telephone, radio, television, jet air travel, and now computers. The key in accepting any new technology, especially in the classroom, is to utilize it when it truly will enhance the learning and teaching process. What is the reason for using the technology? How will it change what I do in the classroom? Can I keep it from becoming a crutch or substitute for good, quality teaching?

General Session: Technology Implementation/Educational Reform

Isolation and Unique Educational Settings: North County San Diego Court Schools Link With the University

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Key Words: **court schools, collaboration, professional development**

Project Description

The San Diego County Office of Education acts as a school district for the mandated programs designed to support the educational needs of students who cannot, for a variety of reasons, fit into the regular school environment. In the North San Diego County area this function is coordinated through a center administratively located in San Marcos but functionally distributed in store front and remote classrooms throughout the North County. Collectively referred to as a single school, the Community Schools are isolated in ways for both teachers and students that cannot be imagined by the traditional school educator.

For the teachers the geographic isolation is unparalleled. They have no colleague next door with whom to discuss curriculum and student issues while having to operate essentially as one room school houses. Although they travel to attend faculty meetings on a regular basis, access to a wide range of learning resources is delayed by delivery schedules and competition for scarce resources.

For students, the isolation is intentional as they have been purposefully removed from either their environment or the school for their own protection and at the direction of the court. While some students require isolation and focus to achieve in a learning environment, none require isolation from the appropriate role models and quality learning resources available outside the school environment.

The San Diego County Office of Education is in the process of facilitating direct Internet connectivity for each of the Court and Community School sites. Unique and varied funding mechanism for infusing technology into programs such as the court and community schools are being utilized. The influx of the equipment coupled with the connectivity has forced the issue of staff development in this unique setting to become a high need.

Project Implementation

CSUSM faculty met initially with the full faculty from the Court and Community Schools to: (1) assess their needs for being able to fully implement technology in their teaching; (2) establish an agenda of topics for professional development sessions, and (3) elicit commitment from participating teachers. Out of this meeting came the collaborative team consisting of teachers, technology coordinator, and CSUSM faculty. The collaborative team collected data regarding student interest and concern about the use of technology, equipment access at each site, resources available to teachers/sites, and the level of proficiency of participating teachers.

The academic year has been spent conducting a series of workshops designed to meet the needs of the teachers. Workshop topics have ranged from utilization of a specific piece of software to appropriate use of Internet resources for the unique student population. Specific curriculum projects have been introduced that focus on building positive self-esteem, developing higher order thinking skills, combining manipulatives with technology, and addressing the needs of the multilingual students. Project examples and student work will be shared at the session in addition to what has been learned addressing needs of teacher isolation in this unique setting.

Spotlight Session: New Curriculum Designs/Instructional Strategies

Museum in the Classroom

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Key Words: **Internet, classroom, museum, telecommunications, engaged learning**

The following is an excerpt from the Request for Proposals, Museums in the Classroom Projects, issued by the Illinois State Board of Education. The program is part of recent legislation that authorized the Illinois State Board of Education to increase the quantity and quality of student and educator access to the online resources, experts and communication avenues available to schools throughout the state.

As part of that effort, the Museum in the Classroom Projects matches schools and museums so that they can develop online, interactive curriculum projects that utilize the unique resources and capabilities of Illinois museums. Through the use of technology and telecommunications, learning is extended beyond the four walls of the classroom, allowing students access to the wealth of history, artifacts and fine art of Illinois' museums.

The Museum in the Classroom Projects enable museums or consortia of museums to share via the Internet those collections that can be used effectively in Illinois classrooms. The resulting projects present online digitized images and documents, coherent learning objectives, effective lesson plans, and thoughtful and logical organization.

Classrooms chosen to participate work with museums through interactive videoconferencing to jointly explore and transmit the components of their rich learning environments onto "home pages" on the Internet. Students assist in the development of these projects by serving as researchers, analyzers, evaluators, constructors of knowledge, and communicators during this process. School staff are able to explore how telecommunications can enhance the learning environment while at the same time teaching students technological skills that will increase the likelihood of a successful transition from school to work.

Interactive technology applications have the potential to enrich and improve the learning environment by instantaneously connecting the classroom to outside resources, experts, new curricula, and communication avenues. The focus of the projects is to engage primary materials, data, and expertise in an open-ended way, using museum collections to allow students to explore the world and participate in the activities of such professionals as astronomers, historians or paleontologists. The benefits of these projects include:

- immediate access for learners to up-to-date, accurate primary source data from a variety of sources;
- more engaged learning, with students taking more active roles;
- increased contributions for students to the general knowledge base;
- increased relevancy of learning activities, relating concepts to real issues and real results;
- increased involvement by students in community-based issues;
- new roles for learners in high-level problem-solving and in working as teams;
- increased technical skills by learners and educators;
- increased communication among and between educators, resulting in exchanges of lesson plans, instructional approaches, and curricular designs;
- increased knowledge at the school level of the learning potential inherent in telecommunications;
- increased sense of an individual's role in the stewardship of a community; and
- increased awareness and focus by the targeted schools on public policy issues in Illinois.

Each museum applicant was asked to address one or more of the following areas of emphasis in its proposal:

Improvement of Curriculum, including:

- authentic learning (e.g., incorporating real-life applications of learning, using primary resources for research)
- higher-order thinking skills (e.g., problem-solving, inquiry, analysis, reasoning, invention)
- integration of subject matter across traditional disciplines
- incorporation of occupational and life skills
- articulation of curriculum scope and sequence across grade levels and school buildings
- problem-based learning
- communication skills

Improvement of Instruction, including:

- instructional strategies to improve the quality of student work
- opportunities for team teaching and cooperative learning
- coordination of instructional strategies across grade levels and school buildings
- use of library/media resources to enhance instruction
- innovative scheduling and use of instructional time

Improvement of Assessment, including:

- performance assessment instruments and procedures aligned with student outcomes
- data analysis and interpretation
- criterion-referenced assessment systems

Improvement of Information Access and/or Opportunity to Learn, including:

- distance learning opportunities
- use of library/media resource management
- use of online databases and information sources
- communications among teachers and students

Improvement of Professional Development, including:

- technological literacy and hands-on practice
- incorporation of technology-related components into existing professional development programs
- establishment of online communications among teachers across buildings and districts and with professionals in other work fields, including college and university faculty

Each school participating in the Museum in the Classroom Projects must have a technology team that includes two teachers who attend all trainings (one teacher is designated as the lead teacher and is considered the project contact person), the building principal, the technology coordinator or equivalent, and a library media specialist. This team is instrumental in planning for and implementing the project.

Since the program began in 1995, 8 museums and 198 school teams have been selected to participate. Museums in the Classrooms is expected to continue into the 1997–98 school year with an additional 3 museums and 65 schools teams. A link to the Museum in the Classroom projects can be found at the Illinois State Board of Education homepage at http://www.isbe.state.il.us

General Session: New Curriculum Designs/Instructional Strategies

ZANY ZOO: A Collaborative Business/Education/Multimedia Development Model

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Key Words: **early childhood software, educational multimedia development**

This session examines the teaming of educators, artists, programmers and business leaders in the development of early childhood educational software. Presenters set forth the processes of planning such a project and the steps necessary in bringing it to fruition. Many unique features in this project make it a pioneer in a particular approach to creative development of educational multimedia software.

Belarussian-American Exchange Network: A Model

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Key Words: **international programs, school exchange, Belarussian-American exchange, archaeology, videophone, radiation**

Overview

In 1987, during the Cold War, a high school exchange program was initiated between Southern Lehigh High School in Center Valley, Pa. and School #54 in Minsk, Belarus. Since that time, the exchange has blossomed into several unique international programs, providing a network of opportunities for students in both countries to share with one another their cultures and their daily lives. Using technology as an integrative vehicle related to these international activities, the students have been able to share a common global perspective on the world today.

Schools—Participants

Southern Lehigh High School is a small rural high school located near Allentown, Pennsylvania. The school is a leader in the application of technology, and provides the students with a rich and comprehensive curriculum in this area. For many years, technology has allowed the students to reach far beyond the classroom walls, both nationally and internationally.

Minsk School #54 is an English language specialized school which is well-suited for the project at hand, as the language used in the program is English. The school has access to e-mail services and partial access to the Internet. There are two computer classrooms at the school. The videophone is brought to the school for the projects.

All programs within the network have been developed and coordinated by Ms. Olga Klimanovich, originally from School #54 in Minsk and Mr. Walt Tremer, an instructor at Southern Lehigh School District.

The Network of the Programs

During the last 10 years, beginning in 1987, a network of significant activities has been jointly developed between the two schools. Subsequently, the basic program has been expanded to include other organizations and joint activities. The programs serve as an integrated whole, providing a wide range of educational experiences on a global scale.

The programs are divided into two levels: The core and residual programs. There are also a number or short-term projects which were developed as a result of the core program.

Core Programs

School Exchange: Each year, the two schools exchange groups of students, who stay in host families, and attend classes at their counterpart's school. During their stay in the host district, the students participate in a wide range of educational and social activities.

Faculty/Curriculum Exchanges: Teachers in specific areas of teaching, e.g. Physics and Math, visit each others' schools, and jointly examine, share and plan specific curriculum in their field of study.

Radiation Research: In an ongoing research program, students from both schools measure on-site radiation levels, and compare and analyze data via e-mail. Minsk radiation levels are compared to Pennsylvania levels. (Minsk area was affected by the Chernobyl explosion.)

Residual Programs

Archaeological Excavations: Each summer, Southern Lehigh students together with students from Muhlenberg College participate in the excavations of Iron Age burial mounds and village sites in southern Belarus. Belarussian students join the American students in the excavations.

Scout Exchange: A Scout exchange was structured between Scout troops in Center Valley (PA) and Minsk. American scouts traveled to Belarus in 1994 for a month of camping, homestays, and charity work with the Belarussian scouts. Three issues of a joint Belarussian-American bilingual newsletter were produced by the troops.

Short-Term Projects

Student Teaching: University students at Minsk State University took their formal eight-week student teaching experience at Southern Lehigh High School, fulfilling their curriculum requirements at Minsk State Linguistic University.

Joint Student TV Production Company: Belarussian and American students formed a joint TV production company, which produced documentaries of each other's cultural ways of life.

The Educational Rationale of the Programs/Projects

In the rapidly changing world students should experience international encounters as often and as fully as possible. It is not sufficient to travel to another country as a tourist and to see the show-cased culture—it is essential to see and feel a culture from within, to learn and to work together with the people in a different culture. International educational programs provide students with the opportunity to develop their own global perspective and involvement.

The model here has deeply involved the students, as they participate directly in sharing a variety of on-site experiences with their counterparts.

Application of the Technology as the Foundation of the Programs

Technology has played an essential and integral role in the programs, linking together the American and Belarussian students on an ongoing basis. The technology was used to jointly plan the exchange, to bring together students before the actual exchange, during the experience and after the contact. In doing so, new modes of communication were introduced to the students, existing programs were enhanced, and the range of curriculum and knowledge was extended.

Following is the description of the technology used:

> *E-mail* was primarily used for the day-to-day communication in planning the new programs, in discussing the ongoing programs, in exchanging of the results for the Radiation program, in translating the articles for the newsletter, and for one-to-one correspondence of the student participants.

Computers were used in the production of the joint newsletters for the environmental and scout programs, for analyzing data of the radiation measurements, and for other record-keeping functions.

Videophone was used for introducing the participants to each other, for presenting one's cultural elements to the other students, for discussing the layout of the newsletter, for follow-ups on the family visits to talk with the host families upon arrival home, and to examine archaeological artifacts.

Fax-machine was mainly used for communication when the schools did not have a stable e-mail connection, and when the communication called for visual information to be exchanged.

Technology has become an essential part of the international programs, providing a foundation with which to share the basic exchange. It provides an integration between the students and their cultures that was not before available.

The program is structured primarily around the cultural exchange and integration. However, the model has clearly shown that the technology used provides a significant enhancement, communicative foundation and extended capabilities to the program.

The technology now provides a global educational experience far beyond one culture's classroom walls.

Program Feasibility and Application

For a program of this international scope to succeed and become a reality, various prerequisites had to be examined, in order to insure its successful implementation. Resources had to be available in terms of budget; an interested and involved student population had to be available; a valid educational rationale and curricular framework had to be structured; staff leaders had to be supported by administration and community; technology had to be made available and functional; and the political atmosphere between the cultures had to be accommodating.

The convergence of all these criteria has allowed the program to proceed with great success. A careful examination of the model presented can lead to the replication of such a program in various districts nationwide.

General Session: Society Session/New Curriculum Designs/Instructional Strategies
(Organized by ACM SIGCUE)

Collaborative Writing Environments

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Key Words: **collaboration, notetaking, writing, electronic studying**

This presentation will describe and demonstrate the use of networked word processing for exciting new uses in the classroom. Synchronously networked word processors allow more than one writer to work simultaneously in the same document at the same time without interruption. This new capability has interesting implications for creating writing environments to engage students in collaborative writing for its own sake and for creating supportive environments in class to help students succeed. Presenters will describe in detail the creation of synchronous writing environments and demonstrate assignments such as: synchronous classroom discussion, synchronous brainstorming, collaborative story writing, and an improvisational 'freewrite dance.' Networked notetaking is a synchronous notetaking environment for helping at-risk students succeed in regular classrooms. The networked notetaking strategy employs two laptop computers, which are wirelessly (infrared) networked between a student and a notetaker, and macros are used to set up two windows that split each screen vertically. The student takes notes in one machine and is able to see and read the notetaker's notes in the other screen while the lecture is actually happening. Presenters will provide handouts and descriptions of strategies demonstrated.

Workshop

How to Teach Mathematics Online With the PlaneMath Program

Lewis Kraus
Vice President
InfoUse

Barbara Bromley
Associate Professor
School of Education and Integrative Studies
Cal Poly, Pomona

Key Words: **mathematics, Internet, World Wide Web, 4th–7th grade, physical disabilities, aeronautics**

The Presenters

Lewis Kraus is the Vice President of InfoUse, a nationally recognized multimedia research and design company. He has directed over 15 multimedia projects that combine multimedia with education and disability access.

Dr. Barbara E. Bromley is an Associate Professor of Education in the School of Education and Integrative Studies at Cal Poly, Pomona. She is the coordinator of the Assistive Technology Training and Resource Center at Cal Poly, as well as a professor in the special education credential program. Her area of expertise is severe disabilities.

Description

Come use accessible, online InfoUse/NASA math materials designed for 4th–7th graders, based on NCTM math standards, and using fun, aeronautics-related situations.

Summary

InfoUse, in cooperation with NASA, has created PlaneMath—a growing interactive Web site presenting 4th and 5th grade math materials supporting NCTM math standards in an aeronautics context. The project provides lessons and materials for students and teachers online, teacher training to use the program, the opportunity to win prizes, and to cooperatively work with other students. Lessons reinforce math standards on whole number computation, estimation, fractions and decimals, whole number sense, patterns and relationships, number systems, and measurement among others. Selected lessons include routing the shortest trip across the country, flying a herd of buffalo back to the Great Plains, guiding a helicopter rescue over a city, determining the shortest runway needed to land a 747, designing a kite, helping determine what wing designs will fly farther, and seeing how wings provide lift.

The site has been designed for a wide range of learners, including students with physical disabilities. Each lesson features interviews with professional role models in aviation and aeronautics, classroom activities, links to other math and aeronautics Web sites, and information for parents and teachers. This site is free to all participants. Teachers are encouraged to sign-up with InfoUse at http://www.planemath.com

Purpose and Objectives of the Workshop

This 3-hour workshop will provide an opportunity for participants to learn about PlaneMath, a program in support of existing materials that draws from existing math/science curricula, available aeronautics materials, and accessible Web page design principles, and uses the Internet to support an interactive educational experience. Upon completion of this workshop, participants will be able to:

- describe PlaneMath program
- access and use PlaneMath lessons and supplementary pages online
- describe how PlaneMath can be integrated into their classroom curriculum

This workshop is timely and important to professionals in the education, special education, and technology fields. The material to be shown is more than basic "surfing" strategies or introductory Internet usage. Here, the Internet is the medium, providing an unique interactive content that every teacher can utilize.

Outline of Workshop

* Note: Participants will be given hands-on time to work with PlaneMath.

- Introduction to the PlaneMath project—overview of InfoUse/NASA/Center for Accessible Technology/California State Polytechnic University, Pomona partnership and project goals and objectives [15 min.]
- PlaneMath lessons—overview and in-depth training on each lessons and supplementary features [2 hours]
- Integrating PlaneMath into the curriculum [30 min.]
- Question and Answer period [15 min.]

Target Audience

General education and special education teachers, educational technology specialists, curriculum specialists, and other interested conference participants. Maximum number of participants is 30.

Workshop

Lego Meets Its Mac

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Key Words: **Lego, Logo programming, curriculum integration, constructionist learning, problem solving**

Abstract

Lego once the king of the playroom has interfaced with the Apple II and now with Control Lab and Control Systems permits control from both Macintosh and DOS machines. This middle school through high school product provides unique tools for exploring and constructing environments involving machines, sensors and computer programs.

New components make this the best Lego classroom learning tool yet. While designed for middle school through high school laboratory settings these materials are integrated easily into most curriculum areas. Students and teachers are finding their use too exciting to relegate them only to lab settings.

Standard Lego building parts combined with specialty pieces provide a very comprehensive student kit capable of exciting even the most reluctant learner. A working temperature sensor can be programmed in either Fahrenheit or Celsius. An angle sensor controls even fine movements. A digital light sensor provides opportunity for feedback exploration. An analog touch sensor, sound element, and light complete the electronic components of the student set.

Teachers using these materials enjoy a high level of student involvement. Getting students involved with problem solving is likely on every teachers wish list. With Control Lab and Control Systems the problem solving takes place on four important levels. First students must determine how to build their Lego machine. Second they must make it mechanically operational. Third they must add programming to control the device. Finally from planning to implementation students must learn to work cooperatively with classmates as they proceed.

On-screen tools provide students with a means to display information about their project. Graphing tools allow experiment results to be displayed even as the results are taking place. Students can begin by building devices described in detail with the materials or build devices of their own design.

Participants will learn to control Lego devices from screen commands and programs. The use of sensors will be explored. Participants will learn how to integrate these materials into their curriculum.

General Session: Society Session/Current/Emerging Technologies (Organized by EMCI)

Electronic Publishing the Right Way

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Key Words: **World Wide Web, HTML, SGML, DTD**

Ideally, a document should only be created once and yet published many times on different publishing media, on demand, and on the fly. Yet, many businesses today are still making repeated mistakes of re-editing the same document to suit each publishing medium. For example, a university catalog is first created on a word processor, then sent to the typesetter, and finally the printing firm. The same catalog must be converted by yet another editing process into a Web document, a document with its structure tagged in HTML (the HyperText Markup Language) for Web publishing. A third authoring software with its own browser is then used to re-create and view the catalog on disks. Yet a fourth authoring software with its browser is used to create and view the catalog on CD-ROMs. Worst yet, all four processes must be repeated at tremendous costs of time and labor for any modification or revision.

The solution is to create documents using SGML (Standard Generalized Markup Language). SGML is an ISO standard to create structured documents free from computing platform, editing software, format, style or presentation. The widely used HTML is but a document type instance derived from SGML. But now HTML contains too many enhancements, such as style and format tagging rules making HTML useless except for Web Publishing. The SGML documents can easily replace HTML documents.

An SGML document is an ASCII text with "tags" to mark only the structures of a document (header, paragraph, table, lists) according to a specific DTD (Document Type Definition). This DTD defines the tags and the relationship among the tagged texts for a particular document type. Since an SGML document consists of structural components and their relationships, it is most suitable for database storage (as "objects") rather than a single flat file. With properly configured computing system and pre-defined production rules, an SGML document can then be published automatically by attaching a user selected style sheet at the last minute for any medium such as paper, diskettes, CD-ROMs, and Web (automatic SGML to HTML downward conversion) on demand. The modification of any document simply means modifying the database content once, rather than modifying, and reformatting the rigid documents using specific editing processes each time for each additional publishing platform. Because the documents are stored as components and structures, there is the added benefit for users to retrieve only the specifically needed information without retrieving the entire document, thus shortening the access time, creating Web pages with highly relevant content, and lessening the network traffic.

A state-of-the-art SGML based electronic publishing system is being setup at Norfolk State University under a software grant from EBT (Electronic Book Technologies, Inc.). The experience will be presented as a case study.

Internet Poster Session

Internet Tapestries: Weaving the Web Into the K–12 Curriculum

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Key Words: **Internet, evaluation, selection, Web integration**

Today's students are becoming Web weavers. The Internet is their loom, information is their yarn, and the dyes are the motivation, interest, and excitement students bring to online projects. They're exploring information resources, contributing to online projects, and designing their own Web pages to express their ideas, interests, and perspectives. Developing Web weavers involves helping students become effective users of Internet technology. To make this happen, educators need to develop a vision of Internet integration in their classroom. This vision can be thought of as an Internet Tapestry—a project that contains rich, complicated designs. An Internet tapestry involves more than letting the class surf the Web, it requires careful planning, flexible learning activities, and project-based environments. Students need skills in selecting and evaluating Internet resources.

Students and teachers need skills in evaluating, selecting, and integrating Internet resources into their classroom projects. There are many sites that can help you learn to critically evaluate Web resources. Start with the Connections site (www.mcrel.org/connect/plus/critical.html). It provides links to many of the most popular critical evaluation resources. For example, Kathy Schrock's Guide for Educators (www.capecod.net/schrockguide) contains evaluation forms for elementary, middle school, and high school levels as shown in Figure 1. CyberGuides (www.cyberbee.com/guides.html) also provides checklists for evaluation of Web sites. Finally, the "Teaching Critical Evaluation" page (www.science.widener.edu/~withers/webeval.htm) explores ways of evaluating different types of Web sites. Compare and contrast the selection criteria at each site and use this information to create your own evaluation checklist for yourself and your students.

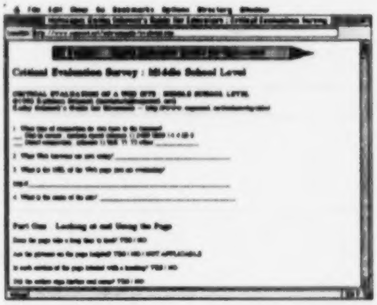

Figure 1. Kathy Schrock's Evaluation Sheet

Web Site Evaluation

With thousands of Web pages available on every topic imaginable, how do you decide which are best for your classroom? Careful evaluation is the key. You don't need 30 Web pages for a project. In most cases, you need to find three sites that contain accurate, useful information. Library/media specialists have always done a great job evaluating materials for the school media center. The selection criteria used for evaluating books and videos can be applied to Internet resources and expanded to focus on some of the unique aspects of Web materials. Let's explore some key issues in selecting Web sites for your classroom.

Goal of Site. Consider the purpose of the site. Is the goal stated? Is the mission served? Does the site possess literary, artistic, or social value? Does the goal match your needs? Consider the Nine Planets site (www.seds.org/nineplanets/nineplanets/intro.html) in Figure 2. It states that the site was designed for nontechnical people who are interested in basic information about our solar system. This would be a great site for kids!

Figure 2. Nine Planets

Appropriateness of Site. Think about the grade level and ability level of your student. Is the site focused at an appropriate reading level? Is the site free of inappropriate language or graphics? Is any bias or opinion easy for students to identify and discuss? Does the site foster respect for all people including women, minorities, ethnic groups, disabled, and aged? Does the site reflect a culturally diverse, pluralistic society? Does the site reflect global awareness? Given the maturity of your students, can they "handle" the content of this site?

Accuracy. The quality of information is critical. Is the information credible? Is the information fact or opinion? Is supporting material provided? Are associated links provided? Do links work? Is a Webmaster listed? Can this person be contacted? Is the site well-maintained and frequently updated? Are comments requested? These are things that can help you make a decision about accuracy. For example, if the site originates at a Presidential Library and is frequently updated, it is probably more reliable than a site sponsored by an individual without any special skills or resources. If I were looking for information on Elvis Presley, I'd go straight to the official site in Graceland (www.elvis-presley.com) rather than the "Recent Elvis Sightings" page.

ELVIS PRESLEY'S
GRACELAND

Figure 3. Elvis' Graceland

Scope and Sequence of Content. Examine the scope and sequence of information. Is the content well-organized? Is the breadth of coverage appropriate? Is information presented in a logical order? For example, if you're interested in worms, Worm World (www.nj.com/yucky/worm/index.html) is the place to go! It contains information on each type of worm including pictures, sounds, and video (see Figure 4). There are even worm poems available.

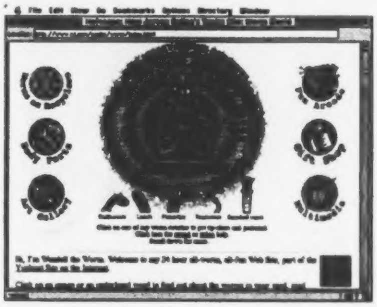

Figure 4. Worm World

Depth of Content. Consider the depth of the content. Is the site thorough? Are links provided for expansion? Are they good? Is the site complete? Does the site provide "real-world" applications? If your students are studying business, the Internet is an excellent tool. Rather than reading dated information from a textbook, students can track the current status of any company from Apple Computer to Burger King using resources such as the Wall Street Research Net (www.wsrn.com). This resource provides annual reports, statistics, graphs, and charts (see Figure 5).

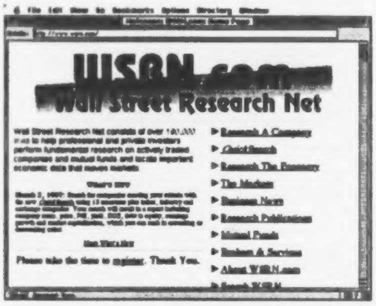
WSRN.com
Wall Street Research Net
Research A Company
Quick Search
Research The Economy
The Markets
Business News
Research Publications
Mutual Funds
Brokers & Services
About WSRN.com
Please take the time to register. Thank You.

Figure 5. Wall Street Research Net

Screen Design. Another important consideration is screen design. If the lettering is too small or the background too cluttered, the page will be hard to use. Ask yourself: Are elements such as navigation tools consistent? Are functional areas provided so you can consistently find the same link options in the same place on the page? Do background and animations contribute rather than distract? Are the font styles and sizes easy to read? Are graphics large enough to see? Are graphics small enough to load fast? The Freezone (www.freezone.com/home) has an attractive, easy-to-use interface (see Figure 6).

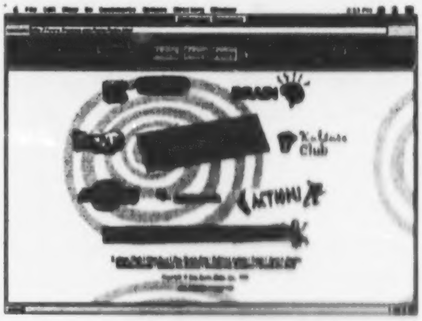

Figure 6. Freezone

Aesthetics. Web pages should have interest and appeal. Is the site easy to use? Does the site have visual appeal? Are the graphics worth the wait? Is the site of interest to the imagination, senses, and intellect? Is the site interesting, stimulating, and engaging? Is the site thought-provoking? The Living in Tokyo (cyberfair.gsn.org/smis/contents.html) Web site contains interesting information presented in a visually appealing way. Figure 7 shows sample pages. Notice the use of white space, interesting fonts, and attractive graphics.

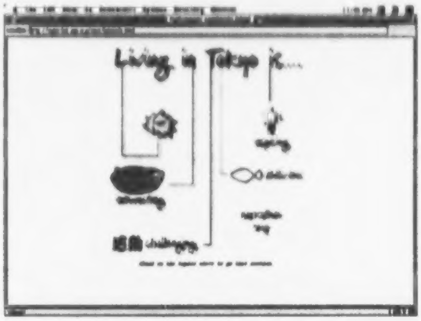

Figure 7. Living in Tokyo

Technical Aspects. Explore the technical aspects of each page. Does the site run without error? Are directions provided for downloads? Does loading take a reasonable amount of time? Do most browsers work with the site? Is a text-only option provided? Street Cents (www.screen.com/streetsite/foodsafety/lobby.html) provides a key word search tool which helps with exploration and navigation.

Accessibility. Examine the site for ease of access. Is the site available and easily loaded? Is the site restricted through password or subscriptions? For example, Journey North is a popular project for children tracking the migration of the monarch butterfly. There are different levels of involvement with the project. People can join free or pay a subscription fee for additional resources and levels of access and involvement.

Navigation. Consider the ease of movement within the site. Is it easy to move between pages? Could you easily return to previous parts of the site? Is an easy-to-use table of contents or index provided? Were links clearly described? Were page lengths kept short to limit options and confusion? The CMCC Museum (www.cmcc.muse.digital.ca) uses the layout of the museum as an easy-to-follow guide through the site. Figure 8 shows how you move from the main entrance to the elevator and into specific rooms of information.

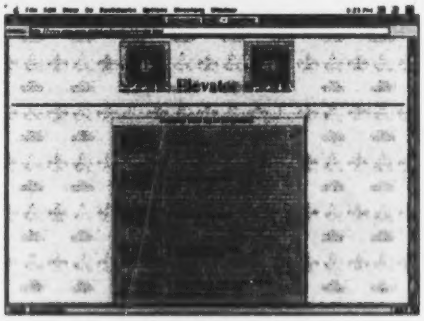

Figure 8. Canadian Museum

Real-World Applications. Consider whether the site contains authentic resources. Does it blend theory and practice? Are there real-world applications of the information? Is the content relevant? Is the site fun? Let's say you've just completed a unit on botany. Students have learned about the parts of the plant and how plants grow. You might take them to The Virtual Garden (pathfinder.com/vg) to explore the application of botany to gardening (see Figure 9).

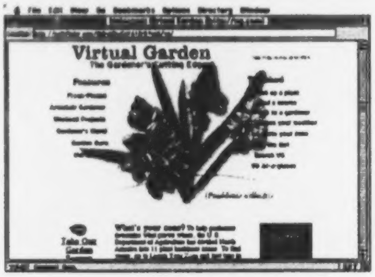

Figure 9. The Virtual Garden

Mediums. Explore the channels of communication represented in the Web site. Does it contain text, graphics, photos, maps, charts, tables, timelines, historical documents, audio, video, and animation? Do you need varied channels of communication for your topic? For example, if you're studying the anatomy of a frog, a skeletal diagram (george.lbl.gov/ITG/Whole.Frog/frog/label1.jpg) would be useful. We often think of the globe from a North American perspective. The globe site (hum.amu.edu.pl/~zbzw/glob/glob43.htm) provides alternative perspectives for student projects (see Figure 10). For students studying a particular country. The Internet can provide sights and sounds unavailable through print medium. For example, the Egypt site (www.mordor.com/hany/egypt/egypt.html) contains music, speeches, and other sounds that can bring the country to life for a student explorer. At Cardworks (www.cardworks.com) adults and children can create electronic postcards that contain animation.

BEST COPY AVAILABLE

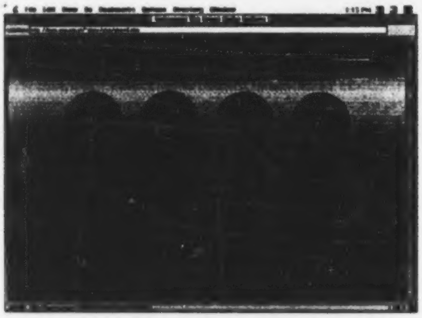

Figure 10. Globe site

Conclusion

Web weavers use the Internet as their looms and information for yarn. Build your tapestry with strong threads by identifying criteria for site selection and carefully evaluating sites that will be integrated into the curriculum. Regardless of whether you have 1 or 100 Internet connections in your school, you can weave Internet Tapestries.

An outline of the presentation along with the links is available on The Magic Carpet Ride web site (magic.usi.edu).

This article is excerpted from Chapter 3 of Cruisin' the Information Highway: Internet in the K–12 Classroom, Second Edition by Annette Lamb and Larry Johnson. The book is available from Vision to Action (PO Box 2003, Emporia, KS 66801: 316.343.7989: vision2a@cadvantage.com).

General Session: Society Session/New Curriculum Designs/Instructional Strategies (Organized by AECT)

Life Rafts to Submarines: New Frontiers in Teacher Education and Technology

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Key Words: **technology, teacher education, educational technology, program development, instructional development, technology courses**

Are you drowning in a sea of technology with no land in sight?

Is your "ed tech" course overflowing?

Do you need a map for the information ocean?

We need more than survival skills to use technology effectively in today's classrooms. We need more than a life raft, we need a high-tech submarine! It's time to explore new frontiers in teacher education and technology. This paper explores ways to integrate technology throughout the teacher education program. In addition, it suggests ideas for the redesign of an introductory educational technology course including instructional strategies and student projects.

Overview

Technology has become an integral part of life for educators and their students. Regardless of whether the task is writing a short story, exploring information resources, examining cultural diversity, tracking a chemistry experiment, testing a mathematical concept, developing new instructional materials, or tracking grades, technology plays an increasingly important role in the teaching/learning process (Lamb, 1996).

The purpose of education is to promote learning. The integration of technology into the teaching/learning environment is essential in preparing students for life in the 21st Century. Educators and students together can activate their learning environment through the effective use of technology. Technology involves all kinds of hardware including computers, CD-ROMs, LaserDiscs, scanners, videos, and even overhead projectors. Technology includes a variety of software from word processing and databases to multimedia and virtual reality. However, most important, educational technology deals with issues of selection, design, development, implementation, and evaluation of all kinds of teaching/learning environments. Quality teacher preparation programs see the ability to effectively integrate technology into the teaching and learning process as an important skill for preservice teachers.

Background

In the Fall of 1994 a 3-year plan named ATAC (Activate Technology Across the Curriculum) was developed as a guide for integrating technology into the Teacher Education program at the University of Southern Indiana. The original plan included background information, assumptions, needs assessment, definitions statements, status, technology program goals and objectives, technology program implementation strategies, and a list of student competencies. Our goal was to integrate effective uses of technology across the teacher education program by (a) providing opportunities for faculty to develop and apply technology skills to enhance their teaching, research, writing, and service activities, and (b) providing opportunities for preservice, inservice, and graduate teacher education students to develop and apply technology skills to enhance the teaching/learning process. In order to reach these goals we've developed relationships within the university and local community as well as with schools and universities outside our local area.

We are currently in the third year of this plan and have made tremendous progress toward our goals. In preparation for ATAC II, the next 3-year cycle of our plan, we have been reflecting on our progress and refining our goals.

Technology Across the Curriculum

Activating technology across the curriculum involves more than a "one-shot" technology course. Faculty throughout the program must be committed to the infusion of technology into their courses. Early experiences require students to refine basic technology skills such as word processing, CD-ROM use, and Internet applications. Middle experiences provide students with important instructional design and technology skills that are needed to integrate technology into the classroom. Late experiences allow students to expand their technology skills in specific content areas and experiment with alternative approaches and classroom management techniques. Culminating experiences encourage students to be creative in the "real world" through student teaching, working with teachers, and designing technology-based final products. Our goal is to encourage new teachers to be explorers, problem solvers, risktakers, and reflectors as they build exciting learning environments for children and young adults.

Early Experiences: Exploring the Teaching Profession

Our teacher education program begins with courses that help students explore the wonderful world of teaching. During their early teacher education experiences, students have opportunities to use technology for their own personal and professional productivity. Students use CD-ROM for information access, the Internet for up-to-date educational resources and lesson plans, and e-mail to reach beyond the local community to K–12 students and teachers around the world. E-mail is a great way to link preservice teachers with K–12 children and experienced classroom teachers. For example, students in the Introduction to Education course use e-mail to interact with a K–12 student for discussions ranging from favorite books to "what's a good teacher." They also connect with other teacher education students and experienced teachers to explore the world of teaching. Students use our teacher education Web site called the Magic Carpet Ride (magic.usi.edu) to explore popular educational issues and identify useful lesson plans on the Internet. Through these initial experiences students build skills and gain confidence using technology for their own personal and professional assignments.

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Magic Carpet Ride Site

Middle Experiences: Building Teaching and Technology Skills

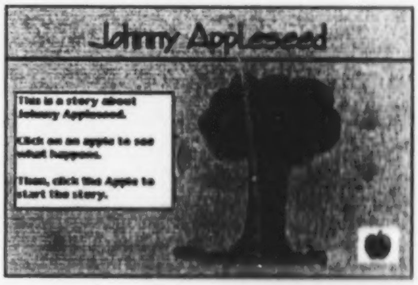
The middle semesters of the teacher education program involve building teaching and technology skills. Specifically, students take the required Introduction to Educational Technology course. In the past, we attempted to teach everything about all the technologies, plus provide hands-on experience and opportunities to explore through field work in this single introductory course. We had 16 weeks to teach 10 courses worth of content. Both the professors and students were overwhelmed. In addition, every semester the course expanded as new technology was introduced. Students who took the course in the fall, missed the neat new experiences available to spring students. By the time students graduated, they were already two years behind! With little hope of having additional courses required, the task seemed impossible. The traditional approach to course revision would be to spend less time with each technology or cut out some technologies completely. Neither approach seemed to meet our goal of providing the skills students need for today and tomorrow. It was time for a paradigm shift.

There were four significant shifts. The first shift was in the **role of the course**. Recognizing that we couldn't teach everything, we've chosen to focus on the design of effective learning environments and identify those areas where technology can play a significant role. The second shift was in the **role of the university instructor**. Rather than being the disseminator of information, the instructor became a mentor, guide, and a facilitator. The **role of technology** became the third shift. The focus moved from an emphasis on hardware and software to a focus on information and communication. As such, the course began to focus on methods for conveying ideas through various channels rather than "making a transparency" or "designing a database." Students now explore and produce informational, instructional, and creativity resources. The role of technology became why, where, and how would technology be integrated into a particular aspect of a lesson. The fourth major shift was in the **role of students**. Again, the focus changed. Instead of a series of unrelated activities and exams, students became project developers focusing on teaching and learning styles and the integration of various technology elements to meet instructional needs. The shifts may seem obvious, but they have transformed the course.

The outcome of these shifts is a sophomore-level course that helps preservice teachers activate the learning environment through the use of technology. The course focuses on both teacher and K–12 student use of technology, while encouraging the development of hands-on projects and practical lesson plans. Rather than teaching the specifics of learning theories or equipment operation, we've focused on those skills that are most important for beginning teachers entering the profession in a new century.

The course begins with skills new teachers need in the design and development of effective teaching/learning environments. The focus is on helping students connect learning outcomes, instructional materials, active involvement of learners, and assessment. Students then explore the design and development of effective informational and instructional materials including print (i.e., letters, manuals, handouts), display (i.e., wall, stand-alone, table), and projected (i.e., transparencies, desktop presentations, multimedia, video production) media. Next, students evaluate, select, and integrate all kinds of informational, instructional, and creativity tools and technologies into the classroom such as floppy-based software, CD-ROM, LaserDisc, the Internet, and video. Finally, the course focuses on technology integration techniques, as well as ideas for managing technology in the classroom.

Although the revised course did an excellent job preparing future teachers, we found that some students were not fully applying their skills to future courses and field experiences. The introduction of a "block scheduling" approach solved this problem for our elementary preservice teachers. "The Block" is an integrated, intensive, and very practical experience that blends university coursework with field participation. The block courses include Instructional Technology in Education, Children's Literature, Cultural Diversity and Human Relations, Developmental Reading, and Language Arts. In addition to their university coursework, these preservice teachers spend lots of time in elementary classrooms. University students work in pairs and are assigned to classrooms by location, grade level interests, and friendships. Students quickly become part of regular classroom activities. With weekly opportunities to work with individuals, small groups, and large groups, they build confidence and valuable teaching experience. The last three weeks of the semester, students spend full-time in the classroom teaching lessons they've developed as part of their four courses. Students select a children's book to serve as the focal point for their lessons which incorporate technology elements. The field experience provides an excellent opportunity for preservice teachers to become part of a classroom and try out their teaching skills. They enjoy seeing their students' work published on bulletin boards and in the halls of their schools. Rather than a traditional final exam, the semester is celebrated with a block party where they share HyperStudio projects, videos they've produced, and other projects they've developed. For example, two preservice teachers used books on tall tales as the focal point for their lesson and developed a HyperStudio stack based on the tall tale, Johnny Appleseed. The elementary students then created their own tall tales. First graders at Stringtown Elementary gave teaching advice to our preservice teachers in the form of a HyperStudio stack and drawings.

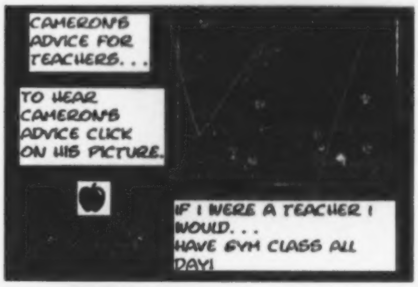


This is a story about Johnny Appleseed.

Click on an apple to see what happens.

Then, click the Apple to start the story.

Johnny Appleseed HyperStudio Stack


CAMERON'S ADVICE FOR TEACHERS...

TO HEAR CAMERON'S ADVICE CLICK ON HIS PICTURE.

IF I WERE A TEACHER I WOULD...
HAVE GYM CLASS ALL DAY!

Kids Giving Teachers Advice Stack

The four block courses are connected with overlapping projects and requirements. For example, students create letters to parents, reading fliers, and activity handouts that are evaluated by both the technology and literacy faculty. Skills in desktop presentation development from the technology courses are applied to the development of a ClarisWorks slide show on a particular genre of children's literature. HyperStudio stacks are developed by students and their K–12 learners based on their literacy lessons. The Cultural Diversity course also connects with technology. Students apply their Internet skills to the exploration of information about culture, race, and ethnic groups on Web pages developed by the faculty. As students evaluate educational software they become more aware of cultural issues and concerns.

HISPANIC
STUDIES

Cultural Diversity Page

Late Experiences: Expanding Technology Skills

Students expand their technology skills in specific content areas through their methods courses. They experiment with alternative approaches and classroom management techniques. A variety of technologies are used including the Internet, CD-ROM, multimedia, tool software,

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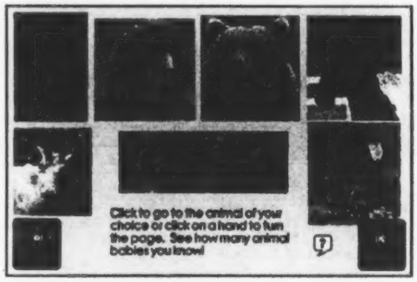
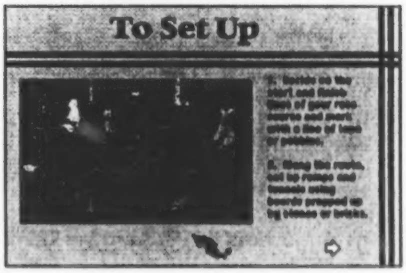
LaserDiscs, lab equipment, and video. The key to effective methods course technology infusion is the identification of specific hardware and software that play an integral part in the course and student projects rather than a supplemental role. In other words, rather than building a "technology day" into their syllabus, technology applications flow naturally from the methods, strategies, and techniques discussed in the particular subject area. As the science faculty explore ways to motivate learners, they demonstrate Journey North, an online monarch butterfly migration project. Music theory software is used by music methods faculty. The social studies faculty use the Internet as a source for current events information. Preservice teachers use computer graphics software in their art methods class. The math methods faculty encourage students to do their presentations in HyperStudio. Finally, literacy faculty integrate reading and writing software, interactive books, and video into their courses.

In addition to the required technology course, our teacher education program offers elective undergraduate and graduate level coursework in the area of educational technology. These courses integrate traditional and emerging technology into the K–12 classroom and encourage our preservice teachers to explore how technology can be used as an informational, instructional, and creativity tool for both teachers and students. Students work with a variety of technology including video, audio, desktop publishing, desktop presentations, multimedia, and the Internet. They develop instructional materials, such as a HyperStudio stack, that helps young children identify animal parents and their babies. They incorporate video, sound, and scanned images. For example, a teacher education student took digital pictures of her students playing traditional Mexican games and developed a HyperStudio stack. Another student developed an interactive book about a trip to Mammoth Cave.



Click to go to the animal of your choice or click on a hand to turn the page. See how many animal babies you know!

Babies HyperStudio Stack



To Set Up

Social Studies HyperStudio Stack

In the summer I took a trip
to Mammoth Cave

Caves HyperStudio Stack

Culminating Experiences: Teaching in the Real World

Culminating experiences encourage students to be creative in the "real world" through student teaching, working with teachers, and designing technology-based final products. By the time our preservice teachers reach their student teaching experience, they've had lots of experiences working with children and exploring the use of technology in classrooms. The student teaching experience provides our preservice teachers with many opportunities to try out instructional strategies and apply what they've learned about technology in schools. For example, Ginger developed a WOW: Windows on the World project on the topic of Mexico with her third grade class. Her third graders reflected on their unit, developed the categories of our trip, our food, our crafts, and our activities, and selected photographs. Amy developed Web pages on the rainforest to share with her second graders, then posted their rainforest drawing and sentences on her Web page. Finally, Cathy decided that she'd like to get to know her class before her student teaching experience began. She created a HyperStudio stack that introduced herself to her class including sounds, videos, and information about herself, her family, hobbies, and favorite things. When she arrived the first day of student teaching, her class felt like they already knew their new teacher.

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WOW Web Page

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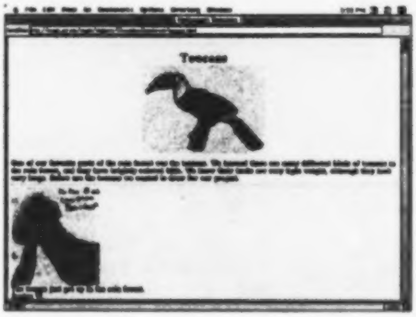
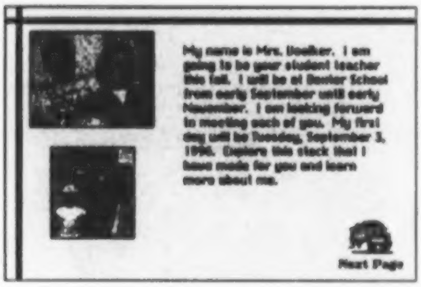


Rainforest Web Page



My name is Mrs. [illegible]. I am going to be your student teacher this fall. I will be at Dexter School from early September until early November. I am looking forward to meeting each of you. My first day will be Tuesday, September 3, 1996. Explore this stack that I have made for you and learn more about me.

Cathy's HyperStudio Stack

Teacher Education and Technology

Activating technology across the curriculum involves more than revisions to technology courses. The entire faculty must be committed to infusing technology throughout the program. Begin by conducting a needs assessment to examine the current status of the program and determine future directions.

Your technology plan must specify the goal of technology in your teacher education program and detail the strategies for implementing change. The key to an effective technology program in teacher education is providing hands-on, practical projects that provide students with opportunities to manage and integrate a variety of technologies in the K–12 curriculum. To make this happen, your teacher education faculty must have access to the hardware, software, and technology skills needed to prepare students for today's classrooms. In addition, the faculty must "practice what they preach" if they hope to instill a love of learning in their teachers. "You can't just read about technology, you've got to do it!" (Lamb, 1997, p. 2) In other words, students need to see models of effective technology use in teaching to become enthusiastic users of technology.

References

Lamb, A. (1996). *Building Treehouses for Learning: Technology in Today's Classrooms*. Evansville, IN: Vision to Action.

Lamb, A. (1997). *MacPac for Teachers: Hands-on Macintosh Applications*. Evansville, IN: Vision to Action.

This article was first posted on The Magic Carpet Ride Web site (magic.usi.edu). For more information, contact Annette Lamb at aclamb.ucs@smtp.usi.edu.

Spotlight Session

Wondering, Wiggling, and Weaving: Exploring How Kids Learn With Technology

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Key Words: **Internet, technology, information literacy, information skills, project-based learning**

Children don't just "do" information and technology. A project-based learning environment involves wondering about a topic, wiggling through information, and weaving elements together. This session traces this process while exploring multiple intelligences of children and the endless possibilities for learner-centered projects using technology like the Internet and CD-ROM.

Project-based learning blends traditional subject-matter goals and objectives with authentic learning environments. This session focuses on projects that require students to explore information, select issues and problems, and apply information-processing skills to the development of a meaningful project. While designing learning environments for children, it's important to consider individual needs and interests along with technology options. Howard Gardner's multiple intelligences provide an excellent framework for constructing strategies for student success. There are many ways to design technology environments to address the specific needs of students in the linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, interpersonal, and intrapersonal areas. By focusing on specific attributes of technology, such as text, sound, still images, and motion images, we can assist students in selecting channels of communication that are most effective for accessing resources, synthesizing information, and communicating ideas. For example, the interactivity and immediacy of Internet technologies are useful for particular types of learners and their projects. As we explore the possibilities for technology it's important to explore all the possibilities from traditional resources (i.e., print, projected, display) to CD-ROM materials, multimedia tools, and Internet resources.

This session focuses on the development of learner-centered, information-rich, problem-based projects: The New W's. This approach focuses on the process students experience in developing projects. **Watching** requires students to become observers of their environment. It asks students to become more in tune to the world around them from family needs to global concerns. **Wondering** focuses on the exploration of ideas. Brainstorming, discussing, and reflecting on questions, concerns, and ideas are all part of the wondering phase. **Webbing** directs students to begin locating information and connecting ideas. One piece of information may lead to new questions and areas of interest. **Wiggling** is often the toughest phase for students. They're often uncertain about what they've found and where they're going with a project. Wiggling involves twisting and turning information looking for clues, ideas, and perspectives. Some learners wiggle with their mind, while others wiggle with their body. **Weaving** requires the highest levels of thinking. Students begin to originate new ideas, create models, and formulate plans. **Wrapping** involves packaging the ideas, solutions, and communications. Why is this important? Who needs to know about this? How can I effectively communicate my ideas to others? **Waving** is the publishing aspect of the project. Students share their ideas, try out new approaches, and ask for feedback. Finally, **wishing** is the reflection point in the project. Students begin thinking about how the project went and consider possibilities for the future.

An outline of the presentation along with the links is available on The Magic Carpet Ride Web site (magic.usi.edu).

An article based on this presentation is available in the April 1997 issue of Learning and Leading With Technology.

Workshop

Avoiding Roadkill on the Information Highway: Practical K–12 Internet Projects

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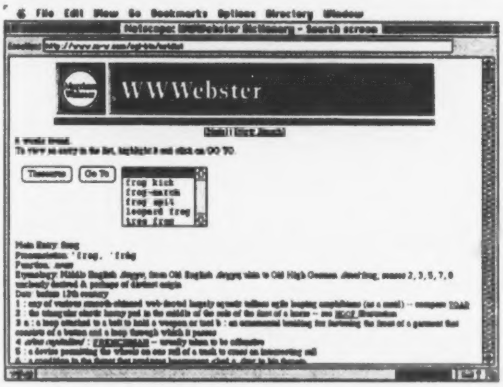
Key Words: **Internet, evaluation, selection, Web integration**

If you've tried an Internet project with kids, you may have felt like road kill on the information highway. With age-inappropriate materials, inaccurate information, and loads of junk, our students need "driver's education" for cruising the information highway. Students need basic skills in accessing, selecting, and evaluating information found on the Internet. In addition, they need to become part of the global educational community by interacting with other students throughout the world. This paper will discuss ideas for selecting Internet sites, developing realistic projects, and integrating Internet into the K–12 classroom along with lots of sample sites and projects.

Selecting Quality Internet Resources

As you select sites for use in your curriculum, be realistic and practical. Do you really need the Internet? Would other resources work faster or better? Why the Internet? For example, using the Internet version of the dictionary as shown in Figure 1 is a waste of time unless you have a computer on every desk. If you need to look up the word frog, why not just use the old-fashioned paper dictionary? On the other hand, if you're looking for the sounds of frogs and pictures of frogs from around the world then the Internet is a logical choice (see Figure 2). The Froggy site (www.cs.yale.edu/HTML/YALE/CS/HyPlans/loosemore-sandra/froggy.html) provides everything a student would need for a frog project.


File Edit View Go Bookmarks Options Directory Window
WWWebster
Thesaurus
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frog kick
frog-march
frog spit
leopard frog
tree frog

Figure 1. Internet Dictionary

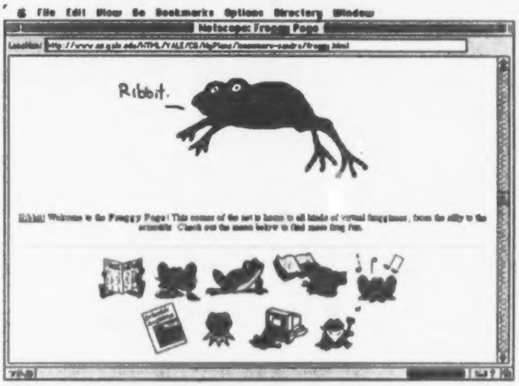
File Edit View Go Bookmarks Options Directory Window
Netscape: Froggy Page
Ribbit.

Figure 2. Froggy Page

Select only quality information resources. With thousands of choices, pick only the best. If it's not good, don't use it. Ask yourself: Does it fit your curriculum? Does it meet student needs? Is it written at the right level for your students? For example, the Solar System (www.windows.umich.edu) site would be too difficult for younger children, but just right for middle school.

Consider the reading level of your students. If they can't read it, don't use it. Are students skimming or reading? Are the illustrations helpful? What are students doing with the information? Ask students to use the five finger rule of Web sites. As they read through a site, they should hold up a finger for each word they don't know. If they reach five fingers before the end of a page, the site may be too difficult. Although students may be able to use the pictures or videos, the text may be beyond their comprehension.

Match the interest level of your children with the Internet site. The Internet should be motivating. Can the Internet make a topic more interesting? Can you match student interests with Internet resources? For example if you're beginning a unit on biographies, use the biography section of Sports Illustrated for Kids (pathfinder.com/SIFK/index.html) to get students interested in reading about popular sports figures.

Compare the maturation level of your students with the information in each site. Most Internet resources are written for adults. Is the information written at your level? Is inappropriate information included? Is it "over" their heads?

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Select timely topics for your activities on the Internet. Use the Internet for "one-shot" timely topics such as the election or the Olympics. The Darkhorse (www.darkhorse.msnbc.com) is an excellent election simulation to use with students as they are learning about the election (see Figure 3).

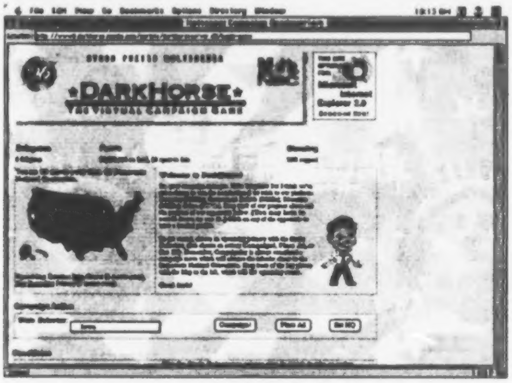

Figure 3. Darkhorse Site

The Internet is best for current information not available in other formats such as information about the economy, weather, and human conflict. For example, you're unlikely to find up to date information about the civil war in Burundi, Africa anywhere else but the Internet. With the Internet you can find maps, information, and calls for action. The Map site (198.76.84.1/HORN/images/horn_mov.gif) and the Minority Rights site (www.nsws.com/mrg/burundi.html) are shown in Figure 4.

MINORITY RIGHTS GROU

A Minority Rights Group International Profile

Burundi: Breaking the Cycle of Violence

"We lived together and we will live together."

Figure 4. Minority Rights Site

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The Internet provides first-hand information not available elsewhere such as primary materials, historic documents, real data, and personal interviews. The Early American Documents site (earlyamerica.com/index.html) provides the entire document, not just an excerpt which is often the case with a textbook (see Figure 5). The use of authentic documents, such as letters, diaries, and journals, is becoming increasingly popular in schools. The Letters Magazine site (www.signature.pair.com/letters) provide real letters from the past and present. For example, it contains a letter written by a German during World War II.

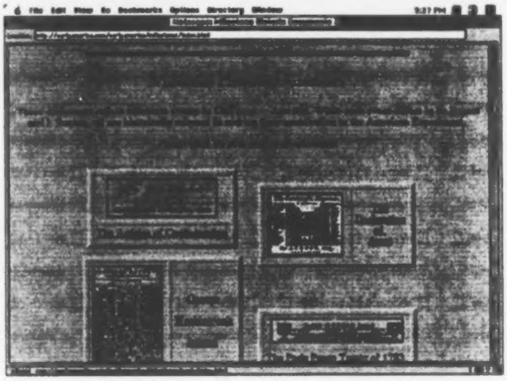

Figure 5. Early American Documents

The Internet is overwhelming; help students narrow their topic by providing starting places. For instance, Idea Central (epn.org/idea) guides students through the exploration of topics such as health care. It's also helpful to provide handouts and Web pages with specific guidelines including directions, questions, and links. The Democracy Project (www.kn.pacbell.com/wired/democracy) is an excellent example of this type of guidance (see Figure 6). This page provides an overview of the project, specific tasks, and links to resources needed to complete activities.

Look Who's Footing the Bill!

An Introductory WebQuest on Democracy and the National Debt

Introduction

Figure 6. Look Who's Footing the Bill!

Help students focus on relevant information by providing evaluation tools, lists of sample sites, keywords, and leading questions. For example, you may direct students to the Hawthorne page (www.tiac.net/users/eldred/nh/hawthorne.html) and design specific activities that use the links from this site. Ant Antics (www.ionet.net/~rdavis/antics.shtml) is another good site for a very specific activity (see Figure 7). For example, after examining the ant antics graphics, students

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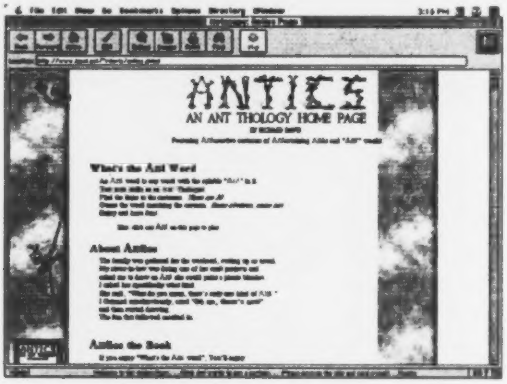
could create their own. You could even print out the ant graphics so students don't need Internet access for the activity.



ANTICS

AN ANT THOLOGY HOME PAGE

Figure 7. Ant Page

Even without a classroom computer, you can use the Internet. Consider printing out activities. They can be laminated or placed in notebooks. For example, the Ink Lesson (cissus.mobot.org/MBGnet/simple/ink.html) in Figure 8 could be printed, laminated, and placed on a science learning center table.

Figure 8. Ink Science Lesson

Use the Internet for remediation and challenge. There are many practice and simulation software packages. Students can even practice for the SAT. See URL: (www.testprep.com/wwmain.sat.html)

Design activities with specific products that ask students to apply Internet information to the production of a paper, poster, brochure, demonstration, or debate. Many online tools can help student prepare. The Online Writery (edweb.sdsu.edu/edfirst/OnLine_Outline/OnLine_Outline.html) helps students with the writing process.

Focus on student involvement. Ask students to "do it": to create, write, discuss, debate, or formulate. In the Adventure Stories (www.execpc.com/adventure) students explore stories and write new endings. Get students involved with online projects (www.usinternet.com/onlineclass).

You may not have enough computers for everyone to do everything all the time. Encourage collaborative projects using Internet resources. You may assign one team to work on the

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computer each day or each week. Maybe one member of the team could check a site once per week. For example you could have students track a bill moving through Congress using the Thomas Web site (thomas.loc.gov) shown in Figure 9.

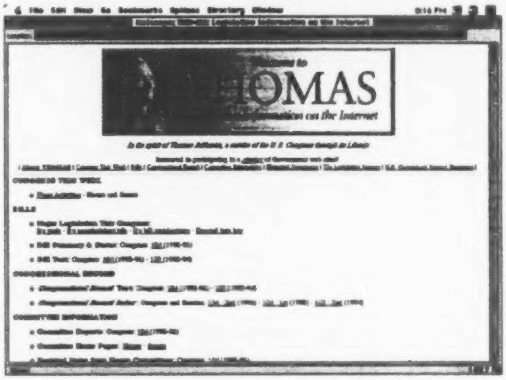

Figure 9. Thomas Site

Effective Internet projects start with the careful selection of Web sites. Use bookmarks to keep track of the sites that your class will be using. Consider creating bookmark folders for class periods, units, or specific activities. Once you get rolling, think about the development of your own Web pages. You don't need a Web server to run Web pages on your own computer. You simply make a page and open the document like you open a file in a word processor.

Conclusion

Successfully cruising the information highway requires carefully selected sites and well-designed lessons. Rather than trying to use everything, select a few quality sites, create meaningful activities, and provide students with time to fully explore the best resources. Students are likely to find inappropriate sites and experience technical problems. By anticipating problems and developing a plan for technology management, you can avoid becoming roadkill on the information highway!

An outline of the presentation along with the links is available on The Magic Carpet Ride Web site (magic.usi.edu).

This article is excerpted from Chapter 3 of Cruisin' the Information Highway: Internet in the K–12 Classroom, Second Edition by Annette Lamb and Larry Johnson. The book is available from Vision to Action (P.O. Box 2003, Emporia, KS 66801: 316.343.7989: vision2a@cadvantage.com).

General Session: New Curriculum Designs/Instructional Strategies

Technology Successes and Pitfalls With Students Who Have Disabilities: Meeting the Education Technology Needs for All Abilities

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Key Words: **disabilities, Special Education, assistive technology products, augmentative communication**

Abstract

Implementing a computer system into the life of a student with a disability can be a daunting task. I wish to share my observations collected as I assist schools with the planning, choosing, implementation and training of technology for students with disabilities.

History

As a full time Special Educator, I used to constantly be on the lookout for new tools to help students overcome the handicapping conditions standing in the way of their learning. Technology at that time was not advanced and options were limited. Once the Apple IIe arrived doors began to open for a few students in my class.

I attempted to research other technologies and to find computer "experts" in the local computer stores who may be able to help me locate more software and hardware to use with these kids. My request was that they provide only new computers and if I mentioned I had a student with a specific disability, they could not envision what the needs might be for that student and what technology might match it.

I began to conduct a great deal of research into Assistive Technology Products. I began to find products which were flexible and user friendly. I could use the products to adapt the Macintosh computer to almost all students with special needs. In addition, the products gave me an assessment tool to determine the student's understanding of technology and if they were ready to move into portable Augmentative Communication.

I found some products to be appropriate not only for students with special needs but for pre-school and kindergarten as well.

Steps to Success

The following are the steps I have found to be the most successful for me and the schools I consult with:

1. Fact finding.

   I gather as much information about the student as possible from as many caregivers as possible. This includes parents, teachers, teacher assistants, speech/language therapists, and occupational and physical therapists.

   I want to know the student's physical and cognitive abilities.

   I want to know what the student's IEP goals are to help determine appropriate software.

2. Skills testing.

   I conduct an informal or sometimes formal inventory of the student's computer skills. The most critical skill the student must possess before attempting to use a computer effectively is cause and effect. They must know that their action, be it clicking the mouse, touching a touch screen or pressing a switch, is what is *causing* the computer to react. This can be tested in a variety of ways on and off the computer. Once I used a touch screen and the "bomb" eraser in Kid Pix® to test one student. She would touch the screen, the screen would blow up, she would laugh and do it again. I knew she had the ability to understand **cause and effect**.

   There are formal, in depth inventories such as "The Lifespace Access Profile" which can guide you through the process.

3. Matching the technology to the needs.

I find this one can be the most time consuming. However, it is much easier if specific goals and needs are determined and please **TRY** before you **BUY!!** We've all experienced hardware and/or software which turns quickly into shelf technology because it is unreliable, or takes too much time to learn or is boring or just can't be used by the student.

If I am recommending technology for several students in one class, I look for products that are flexible and easy to use.

4. Final note.

Do your homework. With the advent of the World Wide Web, the resources are readily available for you to talk directly to manufacturers and more importantly users of specific products. Get yourself on a list serve for a specific disability and ask questions. I have found it better to take longer in the investigative process than to make costly mistakes and have to start all over.

Tried and True Products for the Classroom: (only a very small amount of what's out there)

IntelliTools 800.899.6687 http://www.intellitools.com	IntelliKeys, ClickIt!, Overlay Maker, IntelliPics
Intelligent Peripheral Devices 408.252.9400 http://www.alphasmart.com	AlphaSmart Keyboard
Mayer-Johnson Co. 619.550.0084 http://www.mayer-johnson.com	Speaking Dynamically, Boardmaker
Don Johnston, Inc. 800.999.4660 http://www.donjohnston.com	Ke:nx, Discovery products, Co:Writer
Roger Wagner Publishing, Inc. 619.442.0522	HyperStudio
Poor Richard's Publishing 860.567.4307	Great software for Learning Disabled
Lifespace Access 707.829.9654	Lifespace Access Profile for Individuals with Severe or Multiple Disabilities

Some Web Sites to Look for

Poor Richard's Publishing http://www.tiac.cet/users/poorrich/ http://cast.org/	CAST
Bill Lynn's Hot List http://www.hsj.com/hotlist.html http://trace.wise.edu/	Trace Center

AbleData
http://www.abledata.com/index.htm

General Session: Exhibitor Presentation/Current/Emerging Technologies

Executive Seminar on Safe, Fast, Cost-Effective Internet Access

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Key Words: **Internet access, safe, security, CyberLibrary, firewall, proxy**

Abstract

This seminar provides an overview of Internet access designs and solutions that maximize current technology investments and migrate easily for safe, fast and cost-effective use of the Internet.

JDL Technologies has designed a seminar to introduce educators to strategies of how to be wise consumers of emerging options for Internet access. These strategies will help schools and districts become self-supporting in their Internet access design and implementation.

This seminar provides an overview of Internet access that allows you to start with your current resources and then migrate affordably as your funding and knowledge increase. This process will keep users safe from irrelevant content, secure from malicious intrusion and able to access information quickly. JDL Technologies knows that the answers to your questions are not in hardware or software alone, but rather lie in effective concepts for applying these tools to create real solutions.

A successful Internet access strategy is a balance between three key elements: speed, cost and safety for data and users. These three elements provide the basis for evaluating decisions about Internet access for your particular educational and community needs. This Executive Seminar will assist you in recognizing how each of these factors affects your current resources, community and Internet access strategies for your schools or district.

Principles for accommodating education's Internet access:

- A variety of levels of access and protection will be demanded by teachers, parents, administrators and students. All professional and community needs and desires can be met with the appropriate planning.
- Teachers, students and parents must feel safe and secure. This means that there should be no threat of malicious intrusions from the outside into your network. Furthermore, unauthorized exploration of inappropriate Web sites can be eliminated.
- Security and safety are vital considerations for school systems. The answer is a well-constructed Security Policy which will provide information, plans and procedures on how to enforce acceptable uses.

Three Models of Internet Access Strategies

1. Connectionless access
    - Create a CyberLibrary by acquiring a CD-ROM of licensed Web sites to store on your fileserver
    - Use an Internet browser to access your Intranet and search Web site content at Ethernet LAN speeds
    - No physical connection means no threat of accessing inappropriate material and security of operational information
    - Provide immediate static Web access to your users while planning future dynamic access strategies
2. Dial-up access
    - Permit some users access to the WWW on an "as needed" basis using a modem
    - A Security Policy can be developed centrally to insure the safety required to protect data and users
    - Integrate Web resources into your curriculum immediately while optimizing your current investments
    - Traffic can be managed effectively through placement of proxy technology at the school site so frequently hit sites can be cached in the local server
    - Schools which choose to publish their own Web site may do so with security and safety for their servers and server software
3. Dedicated Digital access
    - Your school or district site obtains dedicated access to the Internet, 56K, fractional T1 or T1
    - Traffic can be managed effectively through placement of proxy technology at the school site so frequently hit sites can be cached in the local server
    - Facilitate your Security Policy using firewall, proxy and filter technologies to protect the data and users on your network

Traditional Poster Session

The Raiderlinks Project: A Laptop-Based, Interdisciplinary, High School Project

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Key Words: **interdisciplinary project, electronic portfolio, laptops, conceptually-based knowledge**

Overview and Objective

This traditional poster session reports on the planning and implementation of a high school's interdisciplinary project called "Raiderlinks." The over-arching goal of the project is to enhance student learning by integrating subject areas, and by incorporating computer-based technologies into daily lessons. Sixty students and six teachers are involved in the project, each equipped with their own personal laptop computer. Students are enrolled in an interdisciplinary block-schedule of six courses (one of which is a computer applications course). A cohort of six teachers, along with the assistance of a university faculty member, planned and taught these courses. They will present the curriculum that was developed, along with examples of lesson plans and samples of student projects. Conclusions about developing and teaching this technology-based curriculum will be presented in depth.

Perspective

A faculty team at Thomas Jefferson High School in Federal Way, WA, has devised "The Raiderlinks Project," a curricular option open to students of all abilities. This project implements an innovative and rigorous curriculum that integrates the study of computer applications, literature, math, science, social studies, and world languages. The project incorporates the use of laptop computers to enhance the work done by individual students and cooperative work groups. The team of teachers who developed and teach in the program meet regularly to plan the use of instructional and study time, coordinate lessons, tasks, projects, and to discuss the work and progress of all the students in the program. The faculty team works not only to instruct and coach, but also to serve as model learners. The metaphors of "student as worker" and "teacher as coach" pervade the program.

Raiderlinks depends fundamentally on utilizing technology in learning. Learning assessments are aimed toward exhibitions and other demonstrations of skill and mastery. The project uses electronic portfolio assessment, student directed research, classroom discussion, and rigorous performance expectations. The ability to use computers and networks as tools for communicating, solving problems, and gaining access to information is a principle focus. As part of their daily use of computer technology, students and faculty interact with networks of students, scholars, and resources available through the library, a local area network, and the Internet. Students also develop the ability to use multimedia tools to present creative exhibitions of their knowledge. Although not constrained by curricular pressure from advanced placement programs or achievement testing, students do continue the normal sequence of standardized testing for college, vocational school, and admission to military service. Students take the PSAT, SAT I, SAT II, ACT, and AP tests in a traditional pattern if their individual learning plans call for their results. Various software programs are used to accelerate the test preparation process and raise the level of performance by any student on any given exam. Laptop computers allow students in the Raiderlinks Project to access these programs from the classroom, or any telephone line.

Raiderlinks differs greatly from the "traditional curriculum" of most high schools, even though it can be implemented with minimal alterations to traditional scheduling. The program establishes at the heart of its curriculum the teaching of skills and content knowledge, while making its focus the academic and personal needs of students who are preparing to live, study, and work in the 21st century. The curriculum depends on an interdisciplinary approach to learning the subject matter, developing skills, and using teachers' strengths.

Raiderlinks allows every student to develop a conceptually-based understanding of knowledge across the curriculum as they engage in a connected pattern of learning and discovery. The infusion of technology into an integrated curriculum provides a model that can be replicated in most any junior and senior high schools. The pilot project is being implemented during the 1996–1997 school year, though parts of the program have been piloted during previous years. This project poses a number of implications for the classroom teacher, curriculum development, and future uses of technology in the classroom.

General Session: New Curriculum Designs/Instructional Strategies

CyberSchool: Delivering High School Credit Classes Over the Internet

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Key Words: **CyberSchool, CyberTeacher, freelance teaching**

The world-wide expansion of the Internet has the potential to facilitate profound change in teaching and learning. For the first time in human history, the geographical location of the teacher, the student, and the learning materials are nearly insignificant factors. This fact alone opens whole new worlds of possibilities in instruction.

Imagine a typical class discussion in an American high school. Most of the students in the room are the same age, were raised in the same area, come from families at the same socioeconomic level, and have the same language, religious background and basic world view. They are discussing World War II. Now imagine this same discussion if some of the students are at home or at school in Nagasaki, and others are in Berlin, Beijing, Moscow, London, and Pearl Harbor. Now also imagine that students have convenient access to an exploding array of original source materials from that era (text, pictures, film) as well as e-mail access to people who actually participated in the events under discussion. Through the Internet, this is all possible today, right now.

Where a student lives has been the single greatest factor influencing the quality of his or her education. What street you live on, what city you live in, what state you live in, and what country you are from determines the limits of your educational possibilities. Your geography controls what classes you can take, the quality of the teachers you can expect, and who your classmates will be. Smaller or rural districts are unable to offer a full range of high quality courses due to limited funding and/or the inability of those districts to attract trained, experienced teachers. Urban districts schools offer greater curriculum choices, but also expose students to the dangers of putting large numbers of 13–20-year-olds into a single building for eight hours.

As funding becomes tighter for public schools, the number of curriculum choices become smaller and smaller. However, the Internet and Internet related technologies make it possible to deliver classes to schools on an individual student basis. Because a class on the Internet can draw students from a worldwide student body, instead of a school wide student body, nearly any class, at any level, is economically feasible. For example, a school that might normally afford to hire one Spanish teacher for 30 students interested in taking a foreign language can instead meet individual interests and needs by purchasing classes on the Internet for 10 students who wish to study French, 10 who want Spanish, 5 who prefer Japanese, 3 who need Russian, and 2 who are ready to tackle Chinese.

Schools will come to discover that it is feasible to hire teachers from anywhere on the planet, with virtually any kind of experience, educational philosophy or credentials they wish. They will be able to offer genuine choices to diverse communities. The Internet will finally bring democracy to education when an inner city student can routinely choose to take Russian Literature or Aztec Architecture from a teacher who is, through training or inclination, an expert in the field.

Teachers have also been shackled by geography. I believe that the teacher of the 21st century will become an entrepreneur; a consultant; a cyberspace hired gun. "Have computer, will telecommute," will be the motto on his or her home page business card. It will not take long for the leaders in the education establishment to realize that they can hire teachers from anywhere on the planet, with virtually any kind of experience, educational philosophy or credentials. They will quickly understand that it is cost effective to contract with teachers on a student by student basis; that it is easy to monitor a teacher's performance; and that teachers are generally happier whenever and wherever they choose.

Likewise, it will not take long for teachers to realize that they can live where they wish, teach only the courses they like, avoid lunchroom duty, and feel safe from bullies, guns and drugs. They may also free themselves from the curricular whims of department chairs, school boards, departments of education, state legislators and federal bureaucrats. And, if the educational establishment does not come to see the advantages of the CyberTeacher, The Discovery Channel or Disney or Scholastic may.

The entrepreneurial teacher will have numerous contracts. He or she may be a consultant to a local company to prepare materials for employee training; may teach face to face on a part time basis for the local school district; may teach a CyberCourse for a growing number of CyberSchools; and may even franchise proprietary course methods/materials to other CyberTeacher.

Until recently it has also been the geographical location of learning materials that has helped to define the limitations of instruction at the high school level. Teachers have always done what was possible—purchase a textbook and present a wide overview of the subject. It was not until post secondary education, and sometimes even graduate education that students could pursue their interests with primary source materials. Students had to content themselves with summaries because it was not possible to provide them with anything else. Courses became like the Platte River—a mile wide and an inch deep. All of that is changing at a blinding speed. The Internet will eventually provide teachers and students with nearly limitless access to primary source materials on any subject in the curriculum. For example, The National Digital Archive is slated to have more than three million primary source documents available to the Internet by the year 2000.

So what is missing from this portrait of materials, students, teachers, and schools interacting over high speed networks? It is certainly not the hardware or the software. Every few months we are bewildered by updated versions of new tools named Java, Shockwave, CU-SeeMe or MBONE. The lack isn't even computers and networking, as tens of thousands of schools rush into connecting to the Internet. What is missing are courses—particularly courses designed and taught by high school teachers who know how to utilize this technology to its greatest advantage and who have access to consulting scholars willing to share their expertise. What we need is a way to produce pedagogically sound classes designed for delivery over the Internet to high school students around the world.

In 1995, Eugene School District 4J launched an experimental program to provide high school credit for courses taught entirely over the Internet. Known as CyberSchool, this program has created the first high school courses to be delivered via the World Wide Web to high school students on a planetwide basis. CyberSchool's current offering include: such offerings as

"Heroes"; "The American Political System"; "Advance Placement English"; and "Bring Literature to Life With Visual Arts." See Appendix p. A59 for a complete list of 1996–97 course offerings.

These high school courses were designed and crafted by teachers in an innovative staff development course jointly sponsored by the Center for Advanced Technology in Education (CATE) at the University of Oregon and Eugene School District 4J entitled "World Class Teacher Training." This course provides teachers with the skills they will need to develop and teach courses on the Internet. Although World Class Teacher Training (http://WCTT.4j.lane.edu) has only been available on a face to face basis up to this point, it will be offered as a CyberCourse beginning in September 1997.

An even bigger problem than teacher retraining and course development lies in the very nature of public education. Public schools are governed, organized, managed and financed based upon geography. States, school boards, and individual schools set the laws, rules, regulations and policies concerning an individual student's public education. Because Internet based programs like CyberSchool make geography irrelevant, clashes between regulations based upon geography and the needs of programs not based on geography will inevitably conflict. For example, a teacher from Canada wanted to teach music theory in our CyberSchool. Although he had secondary certification in Canada and had already been teaching music theory through the Internet within his own school district, by law, I could not hire him to teach in our CyberSchool because he did not have Oregon certification. It obviously does not make sense to require a teacher from Canada, teaching students from Florida, Japan and Germany, to have an Oregon teaching certificate. However, that is currently the case until the Oregon State law can be amended to accommodate a changing world.

As Dorothy said upon landing in Oz, "We're not in Kansas any more, Toto." We certainly are not.

K-16 Computer Science

Java Design Issues and Strategies for the Web's "Global Classroom"

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Key Words: **Java, World Wide Web technology, distance learning, Internet-based instruction, instructional design, strategies**

The WWW features have been successfully used in schools as a tool of distance learning. However, it has still been a method for distributing "passive (or static)" information. The limitations of passive distribution can be overcome by Java. Java provides a new environment on the WWW which allows real dynamic interaction: students receive immediate feedback, and talk to their teacher or students in other places synchronously. Java has great advantages for enriching distance education:

1. Java is platform-independence. Programmers do not need to worry about what kinds of computers schools use.
2. Java applet has multimedia capability.
3. Java applet also runs at the speed of the local computer. After downloading the Java Applet, students in this global classroom will not be frustrated by the awkward movement of the animation caused by slow transmission from the server.

Most Java applets, however, have been made by computer programmers who do not have an understanding of what is needed in the classroom. Many Java applets are fancy, but they are not adopted by teachers or instructors for their teaching. Without considering how Java applets can contribute to meaningful and useful applications, programmers will create applications showing technical flash, but signifying nothing (December, 1996). Also, studies showed that most teachers are not aware of the capabilities of Java. They are wondering "what can we do with Java?" A critical question is "how can programmers make meaningful Java applets for educational situations and how can teachers use Java for their teaching?" To answer this question, first, programmers and teachers should be aware of the capabilities of Java in educational situations.

The purpose of the presentation is to examine the examples and uses of Java[1] in educational situations for programmers and teachers. Specifically, Java can create new levels of interactivity in distance learning situations. Using Java applets, students not only interact with their learning material, but also communicate with other students or teachers from a distance at the same time. Furthermore, students from different places can construct a real-time project together. The focus of presentation will be on the interactivity that Java creates and a Java protocol for the real-time project.

The presentation will demonstrate four different levels of interactivity using Java. First, the interaction between the student and the subject matter takes place on the Internet. Java creates interactive computer-aided multimedia instruction. Multimedia CAI is now available not only on stand-alone computers, but also on the Internet.

Second, Java provides real-time communication. "Chat rooms" or "Blackboards" are examples of Java communication tools. "Chat rooms" have already been used in some Internet projects or courses as communication tools. They allow many students in different places to talk and discuss together through the Web. "Blackboards" in a Web's global classroom are just like "blackboards" in a conventional classroom. Students draw something on the board while students in other places watch the drawings or writings.

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[1] For the examples of Java Applets and information:
http://www-a.gamelan.com
http://www.javasoft.com
http://www.surinam.net/Java/jars
http://Fl1-pc15.fln.vcu.edu

Third, CAI and real-time communication can be combined using Java. For example, while students work with their learning material interactively, they can ask questions of their teachers or discuss the topic with students in other places

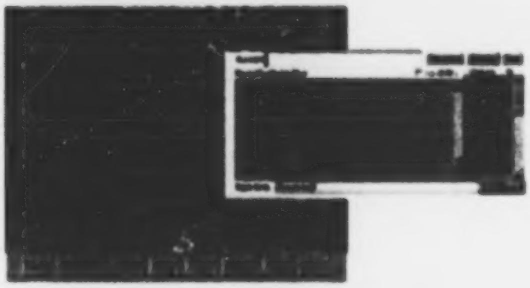

Figure 1. CAI + real-time communication

Fourth, Java makes real-time collaborative projects possible. Using Java, students from different places construct a project together. Figure 2 shows a diagram of a collaborative project with Java. First, students input their data into the data collection program. While the server will store the data permanently, the server will also send updated data to all students' computers so that students will share the output simultaneously.

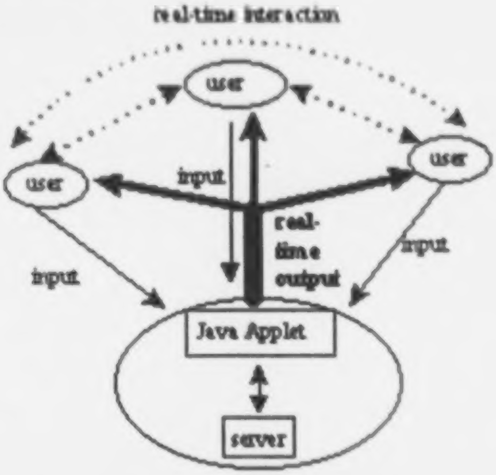
real-time interaction
user
user
user
input
input
input
real-time output
Java Applet
server

Figure 2. Real-time collaborative project

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Figure 3 shows a Java protocol of the real-time collaborative project. In this scenario, students from 12 different states make a Web-based global class. They are building a migration pattern of a specific species of birds. Students in different places record the number of birds they found into their computer every month. The computer screens of all students display the number of birds by visual symbols immediately. The color of circle indicates the date and the size of circle indicates the number of the birds. In this global classroom, "physical distance between students" is not a barrier, but a resource for students' learning.

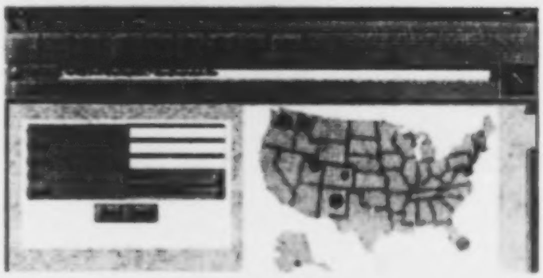

Figure 3. A protocol of real-time collaborative project

Java shows great potential for the future of distance learning or Internet-based education. Real-time data collection at a distance and immediate feedback are possible using Java. Java makes a student-centered global classroom: students manage, manipulate and organize their information without being limited by time or distance.

General Session: Technology Implementation/Educational Reform

Educational Partnerships Open Doors

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Key Words: **educational partnerships, technology partners, acquiring technology**

Summary

Schools have been scrambling to find innovative ways to acquire and integrate new technologies into their classrooms. Some Illinois schools have teamed up with two or more organizations to speed up the process.

The Illinois Alliance of Essential Schools is a organization that includes the University of Illinois and 22 middle schools and high schools around the state. Conferences and training sessions are held throughout the year which focus on educational change, curriculum redesign, instructional and assessment strategies based on current educational research, using new technology, and implementing technology into the redesigned curriculum. Communication occurs throughout the year on the Internet through electronic mail and a World Wide Web site:

http://www.alliance.ed.uiuc.edu/IAES/

The Microsoft Professional Development Program in Illinois is in its fifth year; each year it has expanded to include additional training sites and new software titles. Since 1992, Microsoft has donated substantial amounts of software and training materials, on both Macintosh and Windows platforms, to designated teacher training and preview sites in Illinois.

The school-based training sites provide teacher training on the software and serve as a testbed for the newest Microsoft products. They demonstrate innovative uses of technology in the classrooms, develop training materials, and provide feedback and evaluation on the products to Microsoft. The sites also publicize their involvement with the partnership by press releases and other public relations. The Illinois Microsoft Partnership homepage is located at:

http://www.alliance.ed.uiuc.edu/msoft/

For many of our schools, these associations have been instrumental in acquiring additional funds for technology and educational reform from school districts, state and federal agencies, foundations, park districts, and businesses. This has had a major impact on computer equipment purchases and teacher training in the schools. These partnerships have also been instrumental in changing teachers' attitudes about technology and educational reform as well as supporting inservice efforts beyond the school and district boundaries. Our panelists include university and business partners and school technology directors. Members of this panel will explore critical issues involved in creating partnerships and provide insight into developing educational partnerships in other areas.

Paper Session

The Requirements for Computer Teacher Certification in Taiwan

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Key Words: **computer teacher certification, teacher preparation, accreditation standards**

Abstract

In this paper we described our research results regarding the minimal competency requirements for computer teachers of junior high schools in Taiwan. We have conducted a questionnaire survey to gather opinions from various sources. The survey results identified a collection of six core courses that should be required of those who want to become a computer teacher of junior high schools. It was also pointed out that a computer teacher ought to be equipped with certain other knowledge and skills, such as understanding the strategies for teaching application software or trouble-shooting hardware failures, in order to be a competent computer teacher.

1. The Background

There have been many major changes in the educational policies in Taiwan during the past couple of years. Among them is the increasing emphasis on computer education at all levels of schools in our educational system. Most of all, a new course called ***Computer*** has been added to our junior high school curriculum with the aim of providing education in computer literacy. Starting with the academic year 1997, all our junior high students will be *required* to take the four-credit ***Computer*** course during their second and third years, the equivalents of the 8th and 9th grades in the United States. In line with this change was the announcement, in late 1994, of a mandatory curriculum guideline for the course (Chiou and Wu, 1996). Considering that there are more than 700 junior high schools in Taiwan, such a change opens up great opportunities for those who want to become computer teachers in secondary schools.

Until the present, the administrative rules governing the certification of computer teachers of *senior* high schools in Taiwan are roughly as follows:

1. All applicants for a teacher certificate shall have been granted a bachelor's degree from an accredited college; AND
2. All applicants shall present evidence of completion of not less than 26 semester hours in a general teacher education program approved by the Ministry of Education; AND
3. (a) a major in Computer Science; OR

   (d) a minimum of 20 semester hours of Computer Science coursework in the list of the 17 "acceptable" courses give in Table 1.

Table 1. The 17 "Acceptable" Courses

1. An Introduction to Computer Science
2. Assembly Languages
3. Compilers
4. Computer Organization/Architecture
5. Computer Programming
6. Computer Graphics
7. Data Structures
8. Data Processing
9. Database Systems
10. Design of Microcomputer Systems
11. Digital Logic
12. Microcomputer Hardware/Software
13. Microcomputer Interface Circuit Design
14. Microprocessors
15. Numerical Analysis
16. Operating Systems
17. System Programming

Although it remains unclear whether these same set of standards will be used to certify computer teachers of junior high schools, it appears very likely to be so. Unfortunately, there are many apparent flaws in the above standards. To name a few:

1. No required courses are specified in the standards. That is, a non-major applicant is allowed to complete any combination of the above courses as long as the total number of credits add up to 20. What this implies is that all the 17 courses are considered equally important. In reality, there are a number of core courses that are fundamental in the discipline of computing and thus are generally required by most of the Computer Science departments either in the U.S. or in Taiwan. It is hard to imagine that one can be competent in teaching computer courses without sufficient knowledge of such fundamental courses as operating systems, data structures, or the like.
2. The list of the courses is incomplete. It leaves out many important courses including Algorithm Design, Discrete Mathematics, Software Engineering, and Artificial Intelligence. Furthermore, the list is outdated, too. For example, it does not contain such 'newer' courses as Computer Networks, Virtual Reality, and so on. Considering the fact of rapid advances in computer technologies, it is very difficult, if not totally impossible, to make an exhaustive list of courses which can endure more than a couple of years. As such it seems unwise to attempt a list of the so-called "acceptable" courses.
3. The name of the course does not in itself tell what is actually taught in the course. In some teacher preparation programs it is not uncommon that a course entitled *Database Systems* covers only the operations of a commercial database product, or a *Data Structure* course which does not cover much beyond introductory programming features. Unless there is a detailed description of the contents for each of the courses, and unless it can be ensured that all teacher preparation programs are closely monitored, the names of the courses which one takes are not good indicators of one's knowledge or competency.

The research work reported in this paper is aimed at identifying (a) the collection of required courses that are in direct relevance to the mandatory curriculum guideline stated above, (b) the appropriate number of required credit hours for non-majors, (c) the important concepts and skills of each of the fundamental courses in the computing discipline, and (d) practical knowledge and/or skills that are essential to teaching secondary-school computer courses. Our purpose is twofold—Firstly, items (a) and (b) can be used as a ready reference in case our Ministry of Education decided to revise the existing certification standards. Secondly, we are actually in support of using a computer science examination instead of the current process for teacher certification. In that case, items (c) and (d) will provide useful directions for designing the test bank with regard to the contents of the test questions.

We have conducted a questionnaire survey to gather opinions on the above four issues. In Section 2 we described in detail how the survey was conducted, including the design of the questionnaire and the selection of subjects. In Section 3 we presented partial results of the survey. Section 4 is a discussion on the implications of the survey results, and Section 5 is our concluding remarks.

2. The Questionnaire Survey

The survey is conducted to solicit opinions from three categories of subjects: (1) professors of colleges/universities and the research personnel of various research institutes around the country, (2) computer teachers of senior high schools, and (3) the junior high school teachers who have participated in some inservice training programs in computer-aided instruction, computer literacy, or computer science. The questionnaires were sent to a total of 772 subjects, and 468 (60.6%) among them returned the completed questionnaires.

Our questionnaire consisted of two parts, with Part 1 containing 12 question groups and Part 2 four 'overall' questions. The 12 question groups in Part 1, each related to a specific subject area, are shown in Table 2. For each of the areas we identified a collection of fundamental knowledge items and then prepared individual questions for the knowledge items accordingly. Computing Curricula 1991 (Tucker 1991) has been a major reference during our selection of areas and knowledge items. Due to limitation in space, we are unable to include the entire questionnaire in this paper. However, we listed the questions for Group 1 and Group 12 in Tables 3 and 4 respectively to show how the questions were like.

As for the other four 'overall' questions contained in Part 2, they are described as follows. The first question asked about which computer-related departments should be considered as 'major' departments that have adequate curriculum for preparing their graduates as competent computer teachers in junior high schools. The respondents could either select among a given list of 17 departments or propose names of other departments of their own choices. The second question was for respondents to determine how many semester credits in computer science courses should be required of non-majors who want to become computer teachers. The choices given are (a) 31–40 credits, (b) 21–30 credits, (c) 11–20 credits, and (d) less than 10 credits. In the third questions we asked the respondents to identify the list of the required courses, whereas the fourth question is to obtain the list of "acceptable" courses which, though may not be required, are important enough to be counted in the required number of credits.

Table 2. The 12 Groups of Questions

Group 1:	Programming Languages (13 questions)
Group 2:	Algorithms and Data Structures (4 questions)
Group 3:	Operating Systems (7 questions)
Group 4:	Computer Organization and Architectures (8 questions)
Group 5:	Software Methodology and Engineering (4 questions)
Group 6:	Database Systems (2 questions)
Group 7:	Computer Networks (3 questions)

Group 8:	Computer-related Cultural, Social, Legal, and Ethical Issues (6 questions)
Group 9:	Mathematical Foundation of Computer Science (5 questions)
Group 10:	Computer Application Software (8 questions)
Group 11:	Instructional Methods and Learners' Assessment (9 questions)
Group 12:	Administration and Management Abilities (5 questions)

3. Results of the Survey

Space limitation again prevents us from presenting the results of our survey in its entirety. We have decided to show the data on the required credits for non-majors in Table 5, and the data on the required courses is given in Table 6.

4. Discussions

The figures on Table 5 reveal that most people favor the range of 21 to 30 as the appropriate number of credit hours for non-majors. This is roughly an equivalence of seven to 10 courses. It can also be found out that the numbers of professors/researchers who favor 31–40 credits and those who favor 21–30 credits are almost the same (41% vs. 43%). If the opinions of professors/researchers are to be weighted heavier than those of the other two categories of subjects, then the results seem to indicate that the credit hours of somewhere around 30 will be the best choice.

The figures on Table 6 show that there is a general agreement among the three categories of subjects on which courses should be designated as 'required' in the certification standards. The six courses which obtained higher than 60% of the respondents' support are highlighted in Table 6. There are: *Introduction to Computer Science* (97%), *Computer Networks* (84%), *Computer Programming* (82%), *Operating Systems* (82%), *Data Structures* (76%), and *Database Systems* (67%).

It is worth pointing out that *Introduction to Computer Science*, which ranked first in the list, is a course required by our Ministry of Education on all computer-related departments as an introductory course. The contents taught in the course may have some variations among universities, but they basically provide an overview of computer science. Some departments, including the authors', may include introductory programming in the course and expand it into a two-semester course, while many others offer a separate course for introductory programming which runs parallel with *Introduction to Computer Science*.

The list of top six courses reveals a couple of interesting points which we would like to discuss below:

1. Computer Network ranked second in the list, even before the more 'traditional' courses as data structures, operating systems, etc. This is not surprising considering the prevalence of such hot topics as *information superhighway, National Information Infrastructure*, and so forth.
2. None of the "hardware" courses such as *Digital Logic, Computer Organization*, or *Computer Architecture* were favored as required courses. These results are interesting in the sense that many secondary school computer teachers admitted their own incompetence in teaching hardware-oriented contents, according to another survey conducted by one of the authors (Ho, Wu, and Lee 1995). We may offer two possible explanations for such a contradiction: (a) None of the topics in the curriculum guideline is explicitly hardware-oriented, and (b) hardware-oriented courses are generally thought to be harder to learn, especially for non-majors.

5. Concluding Remarks

In this paper we presented the results of a research which are conducted to find out what should be required of those who want to become computer teachers of junior high schools in Taiwan. We conducted a survey and identified six courses which were considered important enough to be required of all applicants. As to the required number of credit hours for non-majors, we have suggested somewhere around 30 credits to be the most appropriate, based on the data collected. In addition, our survey also identified the fundamental knowledge items, grouped under 12 subject areas, which are thought to be in direct relevance to the curriculum guideline. Unfortunately, this part of the results cannot be included in this paper due to space limitation. The data collected from this survey will be very useful in establishing new standards for certification of our junior-high school computer teachers. It may also serve as a ready basis for comparing certification standards administered by different countries.

Table 3. Group 1 Questions: Programming Languages

	Knowledge Items	Required	Better	Not necessary
(a)	understand the use of flowcharts or pseudocode in describing the major steps of a program	----------	----------	----------
(b)	understand the characteristics of major programming languages	----------	----------	----------
(c)	be able to program in BASIC	----------	----------	----------
(d)	be able to program in LOGO	----------	----------	----------
(e)	be able to program in Pascal	----------	----------	----------
(f)	be able to program in C	----------	----------	----------
(g)	be able to program in COBOL	----------	----------	----------
(h)	be able to program in FORTRAN	----------	----------	----------
(i)	be able to program in C++	----------	----------	----------
(j)	be able to program in LISP	----------	----------	----------
(k)	understand the concept of structured programming	----------	----------	----------
(l)	understand the compilation process of translating a high level program into machine code	----------	----------	----------
(m)	understand the theories of compiler design	----------	----------	----------

Acknowledgment

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Tucker, A. B., et al. (1991). Computing Curricula 1991: Report of the ACM/IEEE-CS Joint Curriculum Task Force, December 1991.

Table 4. Group 12 Questions: Administration and Management Abilities

Knowledge Items	Required	Better	Not necessary
(a) be familiar with the procurement process of computer hardware and software	----------	----------	----------
(b) be able to trouble shoot minor hardware or software problems	----------	----------	----------
(c) be able to upgrade and/or expand hardware components (e.g. hard disks, RAM, ...)	----------	----------	----------
(d) be able to design and set up a computer room for instructional purposes	----------	----------	----------
(e) be able to assist in computerization of administration procedures	----------	----------	----------

Table 5. Results on Required Credits

	College Teachers/ Researchers	High-school Teachers	Junior-high Teachers	Overall
31 to 40 Credits	41%	38%	8%	27%
21 to 30 Credits	43%	48%	52%	48%
11 to 20 Credits	15%	13%	38%	24%
Less Than 10 Credits	1%	0%	2%	1%

Table 6. Results on Required Courses

	College Teachers/ Researchers	High-school Teachers	Junior-high Teachers	Overall
Assembly Languages	21%	28%	22%	23%
Artificial Intelligence	6%	14%	12%	11%
Computer Algorithms	39%	52%	18%	35%
Computer Architecture	42%	59%	46%	49%
Compiler Design	23%	22%	15%	19%
Computer Graphics	16%	21%	14%	17%
Computer Organization	60%	53%	26%	44%
Computer Networks	77%	86%	88%	84%
Computer Programming	91%	85%	74%	82%
Database Systems	61%	68%	70%	67%
Data Structures	83%	84%	65%	76%
Digital Logic	37%	43%	16%	30%
Image Processing	8%	22%	27%	20%

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Introduction to Computer Science	98%	100%	93%	97%
Management Information Systems	28%	34%	31%	31%
Microprocessors	23%	24%	14%	20%
Numerical Analysis	13%	14%	13%	14%
Operating Systems	80%	86%	81%	82%
Programming Language Concepts	38%	45%	37%	40%
Software Engineering	32%	24%	20%	25%
System Programming	37%	46%	29%	37%
Others	10%	10%	6%	8%

General Session: Current/Emerging Technologies

When Students Write With Video, Motivation and Writing Fluency Rise

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Key Words: **video, captioning, writing, learning disabled, deaf**

Writing with Video is a promising multimedia approach to literacy and learning which incorporates captioning technology. Students carefully watch a short piece of video, create text, superimpose it over the video (like TV captions), and show their product to an audience. Over three years, the authors collaborated with teachers at six schools in the Northeast, encouraging them to explore uses of the technology and documenting these uses and effects on learning with deaf, hard-of-hearing and learning-disabled students. The project was funded by the U.S. Department of Education, Office of Special Education Programs.

A captioning workstation consists of a computer (with captioning and word processing software), a printer, two VCRs (one to play original video and the other to record video with captions) and a character generator or overlay box (to display text and sometimes objects over video). Easy access to equipment facilitates its use. For most teachers and students, that means keeping the equipment in a classroom or resource room.

A typical captioning activity begins when a teacher selects or makes a video clip (30 seconds to four minutes works best) and sets learning objectives for students. Students watch the entire segment of video to be captioned, then rewind and watch again bit by bit as they decide what to

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write. From this point, the process closely follows typical writing process practices. Students write individually, in pairs, or in small groups. They brainstorm or create an outline, compose text, print it out, evaluate it (alone, with a peer, or with teacher feedback) and revise until it is considered finished. At this point, the text is superimposed over the video. This is a manual process often done with a partner who provides cues and helps with pacing. Students in our project were highly motivated to create quality work. They played their videos at school for peers and took them home to present to family. Videos, or printouts of the text, also became part of assessment portfolios.

How is caption writing different from other writing activities? Most important, video is integral to the writing process; it provides both a starting and ending point, as well as a focus of study during writing. In the most basic activities, students write about what they see, just as they might write about a photograph. The video serves as a writing prompt and aids students in writing longer, more elaborate texts. They are proud to show their captioned video in school or at home. In other activities, students are required to interact more with the video. For example, one group of students with language learning disabilities watched a series of videos which showed the process of building a structure from 10 blocks of different shapes and colors. Their task was to describe precisely the relevant details about each block—its position, and its relationship to the other blocks—so that someone else could build the same structure just by reading the text. Students evaluated their own captioned videos before receiving targeted feedback from the teacher. Analysis of the caption writing samples, as well as samples from other, similar writing tasks revealed that student writing was significantly better organized, words were more carefully chosen, and the text was more clear overall. In addition, these skills appeared to carry over to the other writing task. Teachers' observations corroborated the findings. One teacher said, "We literally saw results from the first to the second structure."

Some captioning tasks focus less on writing per se and more on understanding the content of the video. One group of sixth-grade students with learning disabilities watched a news program designed for upper elementary students twice a month. Each student chose one story in each program to caption. They listened carefully to the story, replayed it as often as necessary, and summarized it in their own words. The captions, therefore, became a form of notetaking. Students brought their captioned tapes back to the regular classroom. One student noted, "I liked showing my show to the class. It's cool." The teacher agreed: "All students enjoyed this, all made gains." Biweekly tests revealed that students better understood and retained information from the stories they captioned compared with stories they watched and discussed in class but did not caption. This was not surprising, since repeated listening, writing, revising, and reviewing were integral to the process. The teacher also noted "benefits that I didn't anticipate, like self-esteem, critical thinking skills, and the ability to formulate, express and justify opinions."

The captioning process is deliberately slow; students process the video and their text at their own pace. The many steps in the process must be accomplished in order and each asks students to repeat and build on the previous step. This structure keeps the students organized and, for many, the process offers a captivating environment to practice skills that may otherwise seem tedious. When students focus on a narrow objective, receive appropriate guidance from a teacher, and have adequate time to practice, they learn to better assess the quality of their work and make improvements. Teachers, too, have found that captioned videos are a useful assessment tool; they offer insights into students' skills and knowledge.

For "Writing with Video," a free idea book with practical information about captioning, or for information about captioning software for the PC or Macintosh platform, contact Mardi Loeterman.

General Session: New Curriculum Designs/Instructional Strategies

Wings Over Water: A Curriculum for Inquiry

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Key Words: telecurricular communication, environmental problem solving, gender equity

The Wings Over Water project at Page Middle School has instituted a new instructional design with a grant sponsored by the National Foundation for the Improvement of Education (NFIE) and funded by the proceeds from Bill Gates' book, *The Road Ahead*. The focus of the project is to infuse technology in the ongoing theme of environmental education. This cross-curricular program utilizes sophisticated technology to encourage hands-on educational science experiences in an after school club. The students have established ownership of their environment through planning, implementing, and maintaining a self-sustaining biodiverse pond on school property; and by adopting a section of a neighboring river. By anchoring the instruction to outdoor laboratories, teachers are able to create a rich curriculum that promotes critical thinking, decision making and problem solving skills.

A key element of the Wings Over Water project is the after school Discovery Club that involves parents and students in telecommunications at school and at home. Collaboration with the Cumberland Science Museum connects the students to a unique resource for scientific research. While the after school club is open to all of our students, the target group for this project is a mainstreamed rural special education population, particularly gifted girls and resource students. Students are actively engaged in solving the problem, "How do we establish and maintain a self-sustaining pond that has the greatest amount of biodiversity?" In addition to traditional resource material for collaborative projects, students have access to teacher facilitators, parent volunteers, and community professionals. The Word Wide Web is used for inquiry and publishing. Students gather and systematically organize their data. Using a variety of technologies they share their results with peers and the community through multimedia projects, presentations and the Discovery Club Web page (http://www.wcs/pms/pms.htm).

General Session: Technology Implementation/Educational Reform

The Electronic Road Ahead: Infusing Multimedia Into the Elementary Curriculum

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Key Words: **HyperStudio, multimedia, elementary, research, electronic portfolio, museum partnership**

Overview

The Project we are highlighting could be duplicated in other schools.

This session, presented by Jan Lowe from Roosevelt-Perry Elementary School in Louisville, KY represents one of the 22 Road Ahead grant winners from across the United States. These grants were sponsored by the NEA, the NFIE and Bill Gates of Microsoft from the profits of his book *The Road Ahead*.

This project, The Electronic Road Ahead, presented an opportunity for our students to use a technology-infused environment to creatively improve their skills and self concept, to collaboratively create a child's perception of their community, and to develop an awareness of the power of technology and its capacity to help gather, organize, analyze, store and share information from real life experiences. This was a synergistic project combining the energies of a school, a museum and the grant sponsors.

The majority of our students have parents on welfare. Very few live in two parent homes. Many are raised by a grandmother. Ninety-seven percent of our students qualify for free or reduced lunch.

We have technically infused our after school program. The specific two technology goals we set took place in the After School Program. Our intention was to excite these children and hopefully stimulate them to continue this creativity into high school and beyond.

Rationale: If we can get a child off welfare we will produce a tax paying citizen.

Our community participant was The Portland Museum. The majority of our students come from the Portland neighborhood in our city of Louisville. Our children have limited means of transportation and spend most of their time in this neighborhood.

Phase One of this project was the production of electronic portfolios which contained examples of students' 4th and 5th grade school projects; scanned in writing samples, video footages of presentations, thematic unit culminating activities, field trips, parent involvement, grades, book report talks, team collaboration projects, writing portfolio entries, performance event tasks, math portfolio entries and other student selected examples.

Phase Two was a major technology thrust which took this multimedia one step farther. Students used the technology skills gained from the first phase into a research project in collaboration with the Portland Museum. Students used telecommunications through an online connection with the museum to research the history of their community and its founding citizens. This history was written into a multimedia presentation. This multimedia presentation consisted of topics of interest to library visitors. Specifically, the students researched three topics: Henrietta Helm, an African American woman who founded the Portland Colored Evening School in the late 1800s; the Squire Earick house, one of the oldest homes in Louisville; and the Old Roosevelt School formerly a Civil War hospital that was the predecessor of our elementary school today. This presentation is based on a HyperStudio stack where viewers need only to press a button to branch to the next topic. Students helped design and build a kiosk to house this display in the museum.

Not only did students learn through active research about their roots they taught others at the same time. Through hands-on real life projects, this high interest activity infused the higher level thinking skills of Bloom's taxonomy. The school, parents, museum faculty, and parents were all involved. Teachers mastered the necessary skills along with their students. There was a change in attitude as teachers became learners and coaches rather than lecturers in the front of the classroom.

Organizational changes occurred. Students didn't sit in rows of seats. At least one computer per 6 students became the norm. Learning took place during and after school hours. The community partner of the Portland Museum was an active participant as well as a beneficiary of this project.

We intend to maintain this partnership and continue this project's goals in the future.

HTML Resource

Roosevelt-Perry home page is:
http://www.jefferson.k12.ky.us/Schools/Elementary/rooseveltperry/RPHome.html

Workshop

Dancin' With the Net: Introducing Telecommunications to the Classroom

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Key Words: **telecommunications, Internet, global classroom collaboration**

How does one initiate a telecomputing project that involves classroom collaboration on a global scale? The rapid development of technological tools would seem to simplify matters, yet time commitments remain problematic. Indeed, educational telecomputing requires the establishment of a project structure, recruitment of participants, coordination with online partners and continual reflection on both local and global concerns. As its title indicates, this workshop is designed to help the novice take those first, tentative steps onto the dance floor of telecomputing. As such, it will offer general guidelines, from the initial phase of envisioning a project through various concerns of design and implementation, to the outcomes of telecomputing 'dance' routines.

Integrating telecommunications into the curriculum changes the way students learn and teachers teach. By using collaborative online projects, students are often more motivated and self-directed in their learning. The teacher becomes a guide or facilitator of the learning that takes place, coaching and critiquing, but ultimately allowing the students to dance the dance.

Nevertheless, classroom management remains an essential skill, requiring careful consideration of cooperative learning environments, an understanding of available equipment, and continual attention to curricular objectives, pedagogical strategies and individual assessment. Workshop presenters will share experiences in telecomputing to explore questions which help the uninitiated imagine stepping onto this new dance floor.

The Internet provides a vehicle for student interaction. However, this interaction does not occur magically, sprouting from the head of computer terminals. Computer networks afford the opportunity for interaction, but teachers remain critical in inspiring students, planning and supervising e-mail exchanges, and helping a 'community-of-inquiry' construct knowledge and meaning from its interactions. The structure of telecomputing projects is a pre-eminent concern, and one which this workshop will address while considering how students and teachers use the technology to best advantage. By drawing upon successful classroom paradigms like "learning circles" and examining how devices such as listservs, message forums and Web pages can assist student discourse, workshop leaders will offer insight on the intricate interplay of students, teachers, and computer networks in new learning environments.

In technological terms, creating a telecommunication project is relatively easy. What needs to be addressed, however, is the role of facilitating in the global classroom. The fact that students are communicating with their peers in the antipodes, or fellow students in adjoining school districts, often provides the necessary catalyst, but what does the teacher do when it isn't enough? Students may take interest in learning about newfound friends or describing themselves, their school and community, but how do we move beyond the 'keypal' exchange to a more vigorous, and enlightening discourse? Telecommunications provides the perfect vehicle for such exchanges and helps improve reading and writing skills among student participants. Nevertheless, we, as educators, must now think beyond the 'boxes and wires,' the mechanics of "Dancin' with the Net" to discover innovative, and meaningful, ways of introducing telecommunications to our classrooms.

General Session: Current/Emerging Technologies

Wireless Infrastructure in the Information Age

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Key Words: **wireless, connectivity, Internet, microwave, spread-spectrum, LAN, WAN**

This presentation will discuss how wireless communication technologies are revolutionizing the growth of information-age infrastructure in this country, especially rural areas. Included in the discussion will be the features and limitations of current wireless technologies including infrared, microwave, RF, and digital spread spectrum with an emphasis on network and Internetwork building for education. Demonstrations of various wireless technologies will be provided, as will case studies of wireless installations within several school districts. Direct cost and performance comparisons will be made between wireless and leased-line options from telephone companies, as will tips and suggestions for school districts considering wireless or any other infrastructure.

Digital spread spectrum, a formerly Military-only technology which by design is quite resistant to both interference and monitoring, is permitting school districts around the country to provide connectivity between buildings and to the Internet. This connectivity is both faster and less expensive than other options, which is particularly valuable to rural schools which may not have access to other services. Wireless technology can also provide networking options for buildings which are not practical to wire, including historic sites, locations with asbestos or other building materials which shouldn't be disturbed, schools where the computers are mobile, and schools with portable classrooms.

Ranges of both wireless LAN adapters and wireless bridges/routers are steadily increasing as the sensitivity of their receivers increase. This permits a broader range of use without increasing the output power of the transmitter. In addition, the new 5 GHz band recently authorized by the FCC will permit even greater speeds and distances, and pioneering projects like the tropospheric scatter systems promise ever greater flexibility.

General Session: New Curriculum Designs/Instructional Strategies

Collaboration Provides Mentoring, Career Exposure, and Technology Training for Girls

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Key Words: **technology, girls, mentoring, collaboration, careers**

It is regular front page news that increased technological, mathematical, and scientific preparation is required to fully participate in an increasingly technologically sophisticated workplace. Current research also tells us that females face additional factors making them less interested in and less technologically and scientifically literate than boys. A recent report by the American Association of University Women indicates that young females (elementary/middle school age) have fewer experiences using the equipment of science such as microscopes and telescopes. The situation is even more bleak with regard to young girls' experience with computers.

Recognizing that no one organization has all the answers, Susan Marino, Ph.D., Director of the Program for Women in the Institute of Technology, University of Minnesota, and Vivian Johnson, Ph.D., Professor, Graduate School, Hamline University brought together a group of people whose common purpose is addressing this problem. In the process, a technology-based curriculum was developed, based originally on Lego Dacta Control System materials. This curriculum was piloted during the summer of 1996 in two, one-week camps offered to young girls, ages 10–13.

Ninety percent of the girls who attended those camps will be returning during the summer of 1997 where they will have the chance to develop their programming skills in conjunction with their science and engineering projects. The participants will be encouraged to return each summer throughout their middle and high school years where they will expand their technical skills within the context of an increasingly individualized curriculum. By their junior year in high school, the young women will be offered the opportunity to intern in local industries, work in university research laboratories, or continue their education by attending one of the several summer institutes for high school students that are available at the University of Minnesota.

Since the problem of providing computer access, technical training, and career exposure to girls from all socioeconomic backgrounds throughout their middle and high school years is a formidable one, simple solutions are not likely to result in significant improvements. By building a collaborative community of learners, including young women, university professors, classroom teachers, and female mentors from both higher education and industry, we were able to develop a sophisticated model that has a greater likelihood of making a difference. Therefore, the summer camp is just one piece of an evolving, comprehensive program that simultaneously aims to develop technological skills while increasing career awareness by providing access to professional women who use technology in a variety of ways. Factors that we feel should be built into a program targeted at young women include:

1. the need for access to and use of state of the art technological facilities
2. a description of our curriculum design process and the resulting curriculum that includes attention to both cognitive and affective domains
3. a discussion of staffing and their responsibilities
4. creating a tool box of "best" instructional strategies and making sure all team members can implement them
5. the need to access the world of work within and outside the university setting
6. designing and implementing ongoing program evaluation

General Session: Society Session/Technology Implementation/Educational Reform
(Organized by ACM SIGCAS)

Putting Teachers and Parents in Control: Internet Content Labeling and Blocking Technologies

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Key Words: content labeling, Internet, censorship, blocking

Background

> *"The RSACi system was developed to provide parents and consumers with objective, detailed information about the content of an Internet site, allowing them to make informed decisions regarding site access for themselves and their children."*
>
> *—RSAC home page.*

There are approximately 750,000 online users below the age of 18. A recently pronounced goal in the United States for the National Information Infrastructure (NII) is to enable it to provide a level of education to all students that surpasses the highest levels of education available today. Throughout the history of the NII, education and research were a key motivation for the development of the technology, first as the ARPANET, then the Internet, the NREN, the NII, and as part of the United States Department of Education project GOALS2000. Many of the recent initiatives (from about 1989 onwards) have also focused a great deal on the educational capabilities of these networks for K–12 (grade school) students. In addition, a significant reason for the presence of young people on the Internet has been the explosive growth of online services and Internet access, especially through services such as America Online (AOL), CompuServe, and Prodigy. Ironically, this surge of new users has also brought an increase in the availability of adult-oriented content and services, much of which is considered inappropriate for young people.

The situation is further complicated by other Internet controversies involving censorship, anonymity, and government control; the decentralized nature of the Internet; and ill informed media attention. Hence, those who are sincere about preventing censorship on the one hand and enabling legitimate parental control on the other hand are left in a difficult position. One solution that has been proposed that will meet the dual goal of non censorious content selection and screening has been content labeling. Several different labeling schemes now available allow Internet content providers to either self label or to be labeled by third parties with respect to any number of attributes. The areas of greatest concern relate to attributes such as sex, violence, nudity, and language.

In 1994, Senators Joseph Lieberman (D-Conn.) and Herbert Kohl (D-Wis.) chaired a number of Senate hearings regarding the increasing levels of violence in computer games. To address these concerns and to deflect possible government regulation of this media, two major content classification systems for interactive electronic entertainment were developed in the United States These are known as the Recreational Software Advisory Council (RSAC), developed by a coalition of over 25 organizations led by the Software Publishers Association (SPA), and the Entertainment Software Rating Board (ESRB), sponsored by the Interactive Digital Software Association (IDSA). Both were established in 1994.

Both groups are independent, non-profit organizations, but the two content advisory systems are fundamentally different from each other. The RSAC system is a content-based advisory system based upon self-disclosure using an interactive ratings package. The ESRB system is an age-based advisory system based upon the decisions of a rating board. The RSAC system has been used mainly by manufacturers of computer games, while the ESRB system has been used for both video platform games such as Sega and Nintendo and computer games.

The RSAC Content Labeling System

To understand the RSAC labeling system, it is first necessary to understand content advisory systems in general. The basis of any rating system is the way in which it classifies content. Federman (1996) has used the terms "descriptive" versus "evaluative" to characterize content labeling methodologies. In addition, Reagle et al (1996) have used the terms "deterministic" versus "non-deterministic" to characterize the labeling process itself. They also introduce the dimension of voluntary versus mandatory to the rating process. These terms can be defined as follows:

> *descriptive*—a rating system which provides a description of the content of the labeled media and can provide a set of indicators about different content categories.
>
> *evaluative*—a rating system which makes a judgment about content using a standard of harmfulness and typically provides a single rating indicator, usually based upon age;
>
> *deterministic*—a rating process based upon some objective methodology in which the final rating is the result of following the methodology;
>
> *non-deterministic*—a rating process based upon the opinions of a rating body;
>
> *voluntary*—the content producer is free to choose to rate or have product rated;
>
> *mandatory*—the content producer is required to rate or to have product rated by some other agency.

No rating system is purely descriptive or deterministic. Rather, each system varies with respect to where it falls between extremes. Most people are familiar with the Motion Picture Association of America (MPAA) rating system in which a board of reviewers examines the content and then issues an evaluative, non-deterministic rating. The process is non-deterministic because, while general rules of thumb may guide the reviewers' decisions, the process itself is opaque and the results are sometimes at odds with other ratings. It is evaluative because the ratings do not describe the content of the film, but what age group may see the film.

In contrast to the MPAA, the RSAC system is voluntary with specific deterministic criteria by which content is rated in a descriptive manner. Content producers, such as video game makers, answer a detailed questionnaire (either in paper or electronic format) about their content with respect to violence, nudity, sex, and language. RSAC then processes the questionnaire, registers and returns the consequent rating to the company. The company is able to use that label in advertising or on their product. The label consists of a number, between (0–4), for each of the four categories. A rating of All (0) represents the minimum amount of objectionable material. The system is represented in graphical form by a thermometer. The number, or the temperature of the thermometer, informs the customer about the specific content of the package as is demonstrated below in the RSAC advisories for violence:

RSAC Advisories on VIOLENCE for computer games:

0: Harmless conflict; some damage to objects
1: Creatures injured or killed; damage to objects; fighting
2: Humans injured or killed with small amount of blood
3: Humans injured or killed; blood and gore
4: Wanton and gratuitous violence, torture, and/or rape

The RSAC labeling methodology does not specify for whom the content is appropriate, it merely describes the content with respect to characteristics that may be of concern to parents. Since content providers fill out the questionnaire, it is a self-labeling and voluntary system. To ensure public confidence in the RSAC system, the content producer is contractually obligated to rate the content accurately and fairly. Every month a number of registered titles are randomly sampled. Producers who have willfully misrepresented the nature of their content may be fined up to $10,000 and may be required to recall their product from the shelves. Using this system, RSAC has rated over 500 game titles including the popular "Myst" by Brøderbund, "Doom II" by id Software, and "Dark Forces" by LucasArts. Only two companies have ever requested an appeal, and no suits have been filed for misrepresentation.

RSACi and PICS

During the year leading up to the passage of the Computer Decency Act at the end of 1995, a number of Internet specific labeling activities occurred: 1) the U. S. Senate Judiciary Committee heard testimony regarding the "Protection of Children From Computer Pornography Act of 1995" (S. 892); 2) the Information Highway Parental Empowerment Group (IHPEG), a coalition of three companies (Microsoft Corporation, Netscape Communications, and Progressive Networks), was formed to develop standards for empowering parents to screen inappropriate network content; 3) a number of standards for content labeling were proposed including Borenstein's and New's Internet Draft "KidCode" (June 1995), and 4) a number of services and products for blocking inappropriate content were announced, including Cyber Patrol, CyberSitter, Internet Filter, NetNanny, SurfWatch, and WebTrack.

By August, much of the standards activity was consolidated under the auspices of the World Wide Web Consortium (W3C) when the W3C, IHPEG, and 20 other organizations agreed to merge their efforts and resources to develop a standard for content selection. The result of the agreement is the Platform for Internet Content Selection (PICS) standard that allows organizations to easily define content rating systems and enable users to selectively block (or seek) information. It is important to stress that the standard is not a rating system like MPAA or RSAC, but an encoding method for carrying the ratings of those systems. Those encoded ratings can then be distributed with documents or through third party label bureaus.

To aid the rating of large sites, labels may apply to whole directory structures (hierarchies) of a Web site if the label is appropriate to all the content. Labels can also be put on individual Web pages or individual assets on a Web page. This flexibility to rate at different levels is referred to as the *granularity* of a particular rating. The following example demonstrates a label for an RSAC label of language (l=3), sex (s=2), nudity (n=2) and violence (v=0):

```
(PICS-l.0 "http://www.rsac.org/vl.0/" labels
   on "1994.11.05T08:15-0500" until "1995.12.31T23:59-0000"
   for "http://www.gcf.org/stuff.html"
   by "John Doe" ratings (l 3 s 2 n 2 v 0))
```

The PICS encoding specifies the rating service, version number, the creation and expiration date, the page, the rater, and the ratings themselves (other options may be specified but are not shown). Multiple labels can exist for any page. Labels can be included in html documents within the metatag, they can be fetched from the http server using the http get command, or they can be fetched from label bureaus. Hence, the author of a homepage could include a variety of labels on the page itself (i.e., the RSAC, MPAA, or Golf-Fan systems). The http server on which the page resides could have a label or labels for that particular page, and a third party label bureau like the "Good Housekeeping Seal of the Web" could be queried for its opinion of the quality of the Web page

In April 1996, the RSAC rating system was adapted for Internet content under the name RSACi using the PICS encoding standard. The RSACi system is a Web-based questionnaire that queries the user about the content of a Web page or directory tree based upon the content categories shown in Figure 1. Upon completion of the questionnaire, a PICS metatag similar to the one shown previously is returned to the user to be placed in the file header. There is also the option to place the RSACi symbol on the Web page. The service does not currently provide message integrity checks or digital signatures. This service is currently free to anyone interested in labeling the contents of a Web site. Many of the attributes of the previous RSAC system will be extended to RSACi, including the sampling of sites for labeling veracity and compliance with the terms of service that a user agrees to before receiving the label.

LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
VIOLENCE: content may include				
Harmless conflict: some damage to objects	Creatures injured or killed; damage to objects;fighting	Humans injured or killed with small amt of blood	Humans injured or killed; blood and gore	Wanton and gratuitous violence; torture; rape
NUDITY: content may include				
No nudity or revealing attire	Revealing attire	Partial nudity	Non-sexual frontal nudity	Provocative frontal nudity
SEX: content may include				
Romance; no sex	Passionate kissing	Clothed sexual touching	Non-explicit sexual activity	Explicit sexual activity; sex crimes
LANGUAGE: content may include				
Inoffensive slang; no profanity	Mild expletives	Expletives; non-sexual anatomical references	Strong, vulger, or hate language; obscene gestures	Crude, explicit sexual references; extreme hate language

Figure 1. RSACi Content Advisory Categories

The RSACi metatags can be used at several different levels to block objectionable content. The individual parent or teacher with a PICS-enabled browser such as MS Internet Explorer 3.0. can activate the blocking mechanism by setting the maximum acceptable levels for the four content areas of nudity, sex, violence and language and issuing a password to the computer system. There is also the capability to block all unrated sites from downloading into the computer. Thus, the parent or teacher can cause unrated sites and sites with high ratings to be blocked from access until the blocking mechanism is disabled with the password. Similarly, the blocking mechanism could be used at the server or Internet service provider level for Intranets or local area networks connected to the Internet at a single point of source.

International Issues

The threat of governmental censorship of electronic media provided the main impetus for the formation of RSAC and the development of PICS. Until this point, we have only considered this issue with respect to the United States. However, an oft cited characteristic of the digital realm is its global scope. This can increase the difficulty of developing a content labeling system because the cultural norms of violence, language, sexuality, and political freedoms differ across the globe, and there are no cultural boundaries in cyberspace. Hence, content which may be considered appropriate within one culture, may be considered inappropriate to others. Governments have been attempting to legislate technical infrastructure requirements because of indecency or cultural concerns.

BEST COPY AVAILABLE

An immediate difficulty with evaluative labeling systems is that what may be appropriate for one culture may be highly inappropriate for another. Fortunately, the PICS system allows for multiple rating systems, services, and label bureaus. As an example of a potential problem, consider the aversion for Nazi propaganda by the German government. Without requiring draconian regulation of infrastructure or ISPs, Germany could require that all browsers and ISPs use a labeling system and label bureau for filtering information pertaining to Nazism. All PICS compliant browsers must be able to read label system definitions from a configuration file, and the government could be responsible for developing the appropriate rating and labeling services. However, this technique can also be extended even further by totalitarian nations such as China to filter sensitive information, if all access is required to go through gateways that employ filtering software.

Regardless, RSACi has an advantage in the international market because systems that use straight forward content description rather than age appropriate evaluations will have greater applicability and adaptability across multiple cultures. While there is some cultural bias within the RSAC system, efforts to extend the system while keeping it very content oriented would allow it to have international scope. Some countries may associate different icons or names with the ratings differently, but the numeric value of a descriptive rating would stay the same. Countries such as Australia, Great Britain, Singapore, the Netherlands, and France have all expressed interest in the RSACi system as an international labeling standard.

Conclusion

A common saying among those that study the Internet is that, "three months are one Web year." However, there are a number of observations one can make about content labeling today. One observation is that this market is extraordinarily dynamic. Many of the filtering companies discussed in this case study are one to three years old. Some of the companies will likely go out of business, or be purchased or bought by larger content or infrastructure organizations—as has happened with SurfWatch.

The dynamic nature of the Internet leads one to realize the importance of cooperation between the entities discussed. It is imperative that with the chaotic development and flow of information on the Internet, standards such as PICS be adopted at each level of information delivery to bring some sense of order and control to concerned users. And it is in this spirit that RSAC has committed itself as an organization to use the PICS encoding system as part of its labeling methodology and to make its system available as widely as possible in order to fulfill its mission to empower the public to make informed decisions about appropriateness of content when accessing the Web (see RSAC Homepage, http://www.rsac.org).

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General Session: New Curriculum Designs/Instructional Strategies

Virtual Field Trips Into Microscopic Worlds

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Key Words: **microscopic, virtual, PhotoShop, HyperStudio, Kid Pix, videoscope**

Yes, Virtual field trips are enabling classrooms to travel many, many places today with no worries of transportation, money, schedules, etc. Have you ever considered a virtual field trip "inside" a drop of water, a cell, etc.? In an effort to effectively integrate Technology into the Curriculum, a virtual field trip can be taken into a very small, small world! Combining Science, Social Studies, Math, Language Arts... the entire curriculum will come alive with Technology as the tool. Imagine a student studying and then reporting on a cell. Using technology, the child can be placed "inside" the cell! From describing what he sees, hears, feels, smells, etc. he can report to the class much more about the cell than from just reading facts in a book. Imagination and creativity are unleashed and learning is rampant!

The camera and video microscope are effective tools to use with Kindergarten and beyond. Students first explore a small world, then take snapshots with the computer and actually "put themselves into the picture." It's an instant replay of "Honey, I Shrunk the Kids" and the kids love it! Software and hardware used can be as simple as photo CDs, Kid Pix and a regular camera, or more sophisticated with software packages such as PhotoShop and video microscopes.

Suggested software and hardware include:

Adobe PhotoShop	$239.00
ClarisWorks	$69.00
Kid Pix Studio	$39.00
HyperStudio	$89.00
Hardware:	Camera, video microscope, computer

Workshop

Teachers as Architects of Software That Really Meets Curriculum Needs

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Key Words: **educational software, software support resources, customer service, staff development, internet resources, curriculum**

How can teachers convince publishers to develop the software they need? How can meaningful communication between developer and practitioner be facilitated? Participants offer various perspectives and lead interactive segments on the issues to solicit the answers from all the players. Results will be provided to the Software Publishers Association (SPA).

This three-hour session is based on a lively panel discussion conducted at NECC '96 that left participants wishing for more time together to share and explore. A creative game-show format keeps participants entertained while they share professional insights and get to the meat of software issues.

What are the Questions?

It's glitzy, fast moving, and it sells... but is it the best software for your classroom? Does it meet authentic educational objectives and enhance teaching and learning? How do you assess it? What materials accompany it? As an educator, how do you influence what you find on the shelf? As a developer, how do you insure creating quality products that serve your educator customers real needs?

As educators we understand that curriculum should drive technology, and not vice versa. This session brings software marketers and developers face-to-face with their education customers to discover solutions together.

What do the Presenters Have to Say?

The session begins with a creative and lively mini-panel presentation. Panelists offer various perspectives on software issues. Participants learn about technology successes and struggles from the world of an academic dean and classroom teacher, a software designer, a software marketing manager, the education press, and a technology leadership trainer. Here's a glimpse of each perspective:

PANELIST #1—An Educator

Merle Marsh, Academic Dean
Worcester Country School, Berlin, MD
http://www.intercom.net/user/marsh

As a school administrator, I find purchasing software confusing. Companies call about sending software for preview, but I don't always have time to preview everything or to keep track of previews sent. Of course, I'd much rather receive a free copy of the software, but I know that is impossible for all companies to offer. I like to rely upon what I know about software companies such as if other products by that company are appreciated by my teachers and students. Recommendations from other educators are most helpful, as are reviews by software evaluators such as Diane Kendall (Children's Software Press) and Warren Buckleitner (Children's Software Revue, annual All-Star Software List). Most of all, the software has to be something my teachers will use for the courses they teach. And what do they want?...

- quality software that enriches classroom learning, and
- materials designed for classroom use that help teachers integrate the software into the curriculum.

What educators need from software companies:

- quality software without glitzy parts which make kids wait to get to the meat of the product,
- products that fit into current curriculum,
- products that need minimal directions for loading and using,
- products that will work with mid-range computers and can easily be loaded and unloaded (because of memory considerations),

- clear information about products and demonstration of products at shows/conventions,
- low prices, especially when ordering for a number of computers,
- accompanying materials that ease the integration of the software into the curriculum (both on and off computer),
- online updates and online help that really works… not support that arrives two weeks later!,
- sample copies, if possible (I generally refuse preview copies unless it is a product I know I'm interested in. I don't always trust demo copies, for I know the company must put its best into the demo. The rest is a mystery.),
- products that can be download quickly from the Internet.

What educators provide for software companies:

- good press for products we use and appreciate,
- recommendations to parents for home purchase and use,
- recommendations to magazines and newspapers that call about technology,
- recommendations through convention sessions, online chats, online discussions, and promotional videos,
- ideas for improving software and making it work realistically in the PS—Grade 12 environment. I serve on a number of advisory committees for software and hardware companies,
- ideas for promoting the software,
- ideas for accompanying teacher materials.

PANELIST #2—Software Designer

Caroline Earhart, Director of Design
Theatrix Interactive, Emeryville, CA
http://www.theatrix.com

As Director of Design at Theatrix Interactive, I am responsible for working with a team of designers, artists, and programmers to develop the design in all Theatrix products, including the educational content, the game play, the look and feel of the characters, the dialogue, the sound and music, etc. I help walk the line between creating products that engage kids, where they want to play for hours—while at the same time creating age-appropriate content that is in line with current curriculum standards. I am a former elementary school teacher, including 7 years as a computer lab teacher, who left the classroom and became a software designer because of my dismay at the frequent mismatch between what software publishers were making and what teachers were needing for their classrooms.

What a software designer needs from educators:

- help in recognizing the "holes," i.e. the areas where no appropriate software currently exists and identifying instructional material that could be better presented on a computer than by another media,
- information about changing trends in curriculum (developers don't want to develop software for curriculum that educators feel is no longer appropriate),
- a deeper understanding of how kids learn.

What a good software designer provides educators:

- an avenue of communication where educators can have meaningful impact on what goes into software development, including subject area, content, type of approach, etc.,
- a way to really play a part in developing software that helps kids explore learning with open-ended challenges,

- feedback about why certain kinds of software are published and why others that seem important are not published,
- an understanding of why educational software often gets designed primarily for the consumer market, even though it is appropriate for the classroom.

PANELIST #3—Software Marketing Manager

Joyce Serido, Educational Product Marketing
Mindplay, Tucson, AZ
http://www.mindplay.com

Since 1986, Mindplay has been creating educational classroom software for teaching curriculum skills. The company's founder and president was inspired by her own son who was having difficulties in school and needed something more to succeed. We believe that a computer and good software are integral parts of a teacher's toolkit. Armed with these tools, a teacher facilitates learning through more individualized instruction. In our experience, technology acts as a magnet for children, whatever their skill level. However, the software must do more than entertain the child—it should engage them, stimulate their thinking and problem solving skills, and present lessons in more visual ways. And, because we understand that software is only one teaching tool, our programs come with supplemental teaching materials for both interactive and offline classroom activities.

Mindplay believes that teachers are the best judges of their own needs, so the company is committed to working with teachers in a variety of ways:

- working first-hand in real classrooms to beta-test new products and use our findings to adjust product features, benefits, and content,
- depending on teacher practitioners to provide lesson plans, student activity cards, and blackline masters that accompany software products. Last summer, we sponsored the Mindplay Idea Olympics. In Maryland, Iowa, and Texas, small groups of teachers came together to review selected software and prepare the accompanying teaching materials.
- providing free demos that can be downloaded at the Mindplay Web site http://www.mindplay.com
- publishing value-added print resources. Because we particularly support the special-needed market, a special-edition newsletter has been published and distributed free-of-charge on the subject of software and special needs. It includes articles and tips from educators, as well as list of online resources.
- continuing to explore ways to connect with teachers who want to influence the tools companies create to help them do their jobs better.

PANELIST #4—Educational Technology Press

Judy Salpeter, Editor-in-Chief
Technology & Learning Magazine, San Francisco, CA
http://www.techlearning.com

Our goal at Technology & Learning, a national magazine focusing on the world of educational technology, is to provide educators with reliable information about products and approaches that can help them improve teaching and learning. Although we try very hard to test software in a real-world setting, we know how subjective the reviewing process can be and how easy it is to lose touch with what will work in the typical classroom. We count on you—our readers—to keep us in touch with your needs. In turn, it is our hope that the close working relationship we have with many software publishers, and the importance they place on "good reviews," will allow us to pass on educators' opinions in a way that carries weight.

What the magazine needs from educators:

- a few more individuals, with access to classroom computers and a thorough approach to software testing, who want to join our "stable" of reviewers for the 1997–98 school year,
- letters to the editor or other input (at our Web site, for example) about the best and worst of what you're seeing out there.

How the magazine tries to support educators:

- by using educators as our evaluators for reviews in the magazine and as judges for our annual software awards program,
- even though we often review "consumer" titles, we look at them through a school "lens"—examining their strengths and weaknesses in a school setting
- by providing a constantly growing, searchable database at our Web site (www.techlearning.com),
- by providing feedback to software developers, sometimes during the testing phase as well as after the product ships.

Tips for how educators can be heard by software publishers:

- take advantage of school purchasing options and buy school versions WHEN THEY'RE GOOD,
- send software back when it's NOT good,
- write to companies with your feedback, suggestions, offers to contribute to teachers' guides, etc.,
- send publishers copies of reviews that have appeared in district publications.

PANELIST #5—Technology Leadership Trainer

Mary Anne Mather, Co-NECT Schools Project
Bolt, Beranek and Newman (BBN), Cambridge, MA
http://co-nect.bbn.com

I am a former classroom teacher who, for the past 12 years has served as consultant and manager for educational support, curriculum, and staff development programs sponsored by software and hardware companies (Apple, Claris, Mindplay, Random House/American School Publishers, etc.) museums, and schools. Through my recent work as manager of the Educator Connection, Apple Computer's worldwide online education community, and my current work with school restructuring through BBN's Co-NECT Schools, I work closely with educators and their ongoing challenge to integrate technology into the curriculum in meaningful ways under time and budget pressures.

This dual role over the years has helped me to define a balance between what I call the Company and the Customer. I have seen myself as the liaison between these two entities, the educational product providers and the educational community... a sort of a conscience to help companies provide quality products and support programs, while keeping contact and soliciting support from loyal customers. Both educational software companies and educational institutions have a responsibility to one another: The business is obliged to provide a high-quality product that addresses a real need and ensure that their customer uses that product to its fullest advantage. A customer has a responsibility for loyalty, honesty, and ongoing involvement. I offer a few thoughts for each:

- The Company

  In my estimation, there are some simple ABCs that a successful and responsive educational software company has learned...

  A The best educational software companies are those that understand that a satisfied customer is their best "advertising."

B They also realize that selling products to an educational institution is the **"beginning"** and not the end of what can be a very interesting, joyous, and mutually beneficial relationship.

C They understand the importance of a compete to build **"community"** around their products.

My experience includes involvement with numerous projects/programs sponsored by companies that are most successful because they encourage educator input and participation in various ways. A few samples:

- Advisory Councils that solicit ongoing customer involvement in product development, e.g. Apple Computer's annual User Group Advisory Council (UGAC); Apple's Home Learning Advisory Council (HLAC); Tom Snyder Productions' annual Retreat that brings together their developers, resellers, customers, and groupies; and Mindplay Software's Summer Olympics that brought teachers together to write teacher materials to accompany software.
- Programs that offer ongoing support & recognition, e.g. Apple Computer Clubs, Education User Groups, online special-interest communities like the Co-NECT Exchange.
- Promotions and programs that integrate staff development and training with sales, i.e. Education Resources, Apple's and Microsoft's Family Computing Nights.

The Customer

With strong customer involvement, companies can better address the basic needs educators generally define as essential to quality software—flexibility, rich and varied curriculum integration ideas, technical support, and staff development/training. It is essential that educators feel a responsibility to lend insights to the software market, as well as understand that their ideas truly can and do make a difference. The good customer's responsibility includes:

- being proactive about getting involved with quality companies you wish to influence (particularly companies who offer quality products, but perhaps not for the level/subject of your interest),
- demonstrating brand loyalty,
- actively promoting quality products to colleagues and parents (i.e. organizing a family/community technology night),
- remaining dedicated to staying legal/within product copyright boundaries,
- taking the time to become knowledgeable about what is available and understanding what is technically possible,
- having realistic expectations for both product development timelines and pricing.

How do the Participants Contribute?

Unlike most presentations, the content of this session is fluid, rather than finalized. After the panel, participants break into groups to identify their own needs, frustrations, and successes related to educational software and the companies that produce it. Then we come back together to share, as a final product is developed onsite... a publication outlining needs and solutions that will be presented to the Software Publishers Association.

What do the Participants Receive?

Participants are provided with a forum for defining and broadcasting their educational software needs. Additionally, they receive:

- informative handouts and contacts related to software evaluations and recommendations from real users,

- Internet URLs for ongoing software information,
- ideas for influencing the software industry on an ongoing basis,
- direction for spending precious technology dollars wisely.

Two sample handouts are included here. Other items distributed at the workshop are not available in electronic format at this time. They include:

- sample lesson plans from teacher's manuals accompanying selected software products,
- software demo diskettes and CDs for preview purposes,
- sample issue of *Children's Software Press* newsletter,
- sample issue of *Children's Software Revue* newsletter,
- sample issue of *Technology & Learning* magazine
- reprint of Technology & Learning's 1996 software awards issue,
- sample copies of evaluation forms used in software awards judging.

A number of URLs will be pointed out that give current software information. These include:

- Children's Software Press by Diane Kendall
  http://www.ultra.net/~jlengel/csp/
- Children's Software Revue by Warren Buckleitner
  http://www.childrenssoftware.com
- Newsweek Parents Guide Web site includes a column called "School Days"
  www.newsweekparentsguide.com
- Software Publishers Association (SPA) contains a list of software review sources
  http://www.spa.org/project/resource.htm
- Technology & Learning magazine's searchable database of software reviews
  http://www.techlearning.com
- The PEPsite for parents, educators, and publishers interested in children's software
  http://www.pepsite.com/csr/
- Thunderbeam, educational software reviews from the Children's Software Revue newsletter, the Boston Computer Museum, and others
  http://www.thunderbeam.com

This session is grounded in practical needs and solutions. Best of all, the ideas don't stop when the session ends...

What are the Results?

Practical and meaningful communication between software creators and educational practitioners is facilitated, and the results will be collated and reported to developers through the SPA and published on the Internet and in print for dissemination among colleagues. The session provides an opportunity for educators to have their voices heard in ways that really count. The output of those voices will be decided as the session unfolds.

Workshop

Exploring the Art of Electronic Field Trips (Creating Electronically Enhanced Learning Experiences)

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Key Words: **electronic field trips, videoconferencing, video production**

Two educators and one artist (turned educator) invite you to explore the future of how three emerging technologies will affect education. This workshop will engage all the participants in creating a simulated electronically enhanced learning experience using videoconferencing, Internet tools, and desktop video production. Participants will actively learn how to plan, develop and simulate an electronic field trip conceived and cooperatively planned by the entire group.

1. State of the Art!

Through a mini-lecture and discussion participants will gain knowledge about the current state of the art regarding electronic field trips. The discussion will cover the contributions of national offerings from The Fairfax Network and Turner Adventure Learning as well as regional efforts in the midwest.

Culminating Activity: *Participants will use three emerging technologies to construct an electronically enhanced learning experience.*

2. Planning Is Serious But Art Is Fun!

Participants will divide into three groups with assigned roles (a la cooperative learning methods) and tasks related to technology choice (videoconferencing, Internet tools, and desktop video production).

Culminating Activity: *Participants will plan an integrated instructional unit using videoconferencing, Internet tools, and desktop video production.*

3. The Art of Cooperative Learning!

Participants will develop an electronically enhanced learning experience around a chosen theme using videoconferencing, Internet tools, and desktop video production.

Culminating Activities:

A. Videoconferencing Jay Matheson, Coordinator of Distance Learning for Central Indiana Educational Service Center, will facilitate the videoconferencing integration group. The group will plan an appropriate simulated use of videoconferencing as a part of the electronically enhanced learning experience.

B. Internet tools Joe Huber, Technology Coordinator for Greenwood School Corporation in Greenwood, Indiana, will facilitate the Internet integration group. The group will use Internet tools to develop and provide the Internet related portion of the electronically enhanced instructional unit.

C. Desktop video production Susan Tennant, Indianapolis sculptor and desktop video clay animation specialist, will facilitate the third group. This group will plan and produce a variety of desktop videos using clay animation that will highlight important concepts within the electronically enhanced learning experience.

4. Electronic Learning Becomes Performance Art!

The groups will integrate their portions to deliver a cooperatively planned and produced electronically enhanced learning experience.

Culminating Activity*: Participants will determine the value of using new technologies to construct an electronically enhanced learning experience.*

General Session: New Curriculum Designs/Instructional Strategies

The Virtual Canyon Project

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Key Words: **electronic field trips, telelearning, science education**

> *Site Now Under Construction… Exploring and researching deep sea habitats in the Monterey Canyon by way of electronic field trips…*
>
> *—the Virtual Canyon Project*

Description

The *Virtual Canyon* Team shares work in progress as it develops a prototype for student online science exploration and research. The focus is the deep sea habitats in the Monterey Bay Canyon; the project serves as a model of collaboration between K–12 education, an aquarium, and science researchers. **The Virtual Canyon Project is funded by the National Science Foundation Infrastructure for Education Program.**

The Vision

> *The future is not something we inherit; it's something we create.*
>
> *—Lamm, 1994*

Just imagine students, from anywhere, exploring and researching deep sea habitats in the Monterey Canyon via datalinks from the Remotely Operated Vehicle (ROV) and working collaboratively with scientists to create electronic field trips of their own. Just imagine students producing poetry, art, and dance inspired by and reflecting their explorations of this new "ROV world." Just imagine...

Purpose

The purpose of the Virtual Canyon Project is to involve teachers and students in the design and development of a **prototype** electronic field trip to the Monterey Canyon that is accessed through the World Wide Web. Upon completion of the prototype in September 1997, students in grades K–12 will work on real-life projects where they select and manipulate online tools to explore the Monterey Canyon, conduct research projects in a virtual canyon and virtual research lab, and post the methods and findings of their research on the Web for other students to review.

Funding

A two-year grant from the National Science Foundation's Networking Infrastructure for Education (September 1995–September 1997).

Goals

- To establish and maintain a collaboration among the Monterey Bay Aquarium; the Monterey Peninsula Unified School District; the University of California, Santa Cruz; California State University, Monterey Bay, and through the aquarium with the Monterey Bay Aquarium Research Institute.
- To involve students and teachers from six school sites in the Monterey Bay region in the design and development of the project.
- To conduct pedagogical research to assess the impact this project has on students, teachers, and school sites. (There are two parts to the project: 1. Design Virtual Canyon and 2. Use Virtual Canyon after it's completed.)
- To develop curriculum that meets the California State Science Framework and National Standards, and that promotes the most effective teaching methods we know.
- To design an innovative Web site that supports student-centered, project-based learning.
- To develop curriculum that is multidisciplinary, integrates the science, and addresses many different learning styles.
- To give students an opportunity to work on real-life projects with up-to-date data.
- To give students meaningful opportunities to interact with one another and scientists, and publish their projects for others to see.
- To give students and their families an opportunity to participate together on school-based projects at home.
- To provide students with an reiterative educational experience.

Desired Outcomes

- Produce a Web site and supplemental education materials (for example, a teacher's guide, a CD-ROM, and a book describing the development process)
- A model for designing and producing innovative Web sites that support the best teaching methods we know today.
- Establish policy to address copyright and intellectual property right issues.
- Have a positive impact on students (both design team students and future users of the project) with respect to how they learn and do science.

- Have a positive impact on teachers (both designers and users) with respect to how they teach.
- Provide teachers with professional development in technology, science education, and effective teaching methods.

Primary Partners and Their Roles

Monterey Bay Aquarium (Pam Armstrong)
Content and Curriculum

Monterey Peninsula Unified School District (Kam Matray)
Principal Investigator, Project Management

University of California, Santa Cruz (Dr. Trish Stoddart)
Pedagogical Research

Dr. Chris Hasegawa
Evaluation of the Design and Development Process

California State University, Monterey Bay (Dr. Marsh Moroh)
Service Learning (undergraduate students serve as technology support in the six school sites)

Other Key Partners

Monterey Bay Aquarium Research Institute—Images and Content; Research Process—Dr. George Matsumoto

Monterey Bay Aquarium—Jeff Bryant

Pacific Bell—infrastructure (through California Research and Education Network)

Pioneer—equipment for teachers

Silicon Graphics, Inc.—hardware and software tools

Participating Testbed Sites

Manzanita Elementary School, K–5; Seaside
Jerry Giamona

Los Arboles Middle School, 6–8; Marina
Don Livermore

Monterey Academy of Oceanographic Science, 9–12; Monterey
John Whisler

Alianza Elementary School, K–6; Watsonville
Fred Mindlin and Peter Sherman

Aptos High School, 9–12; Aptos
Greg McBride

Watsonville High School, 9–12; Watsonville
Gary Martindale

Production Team

Gordon Freedman and team affiliated with CSUMB Foundation

Instructional Design Team

Marge Cappo—Learning in Motion

Advocacy Group

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SETI Institute

Dr. Kathleen Fulton, Associate Director, Center for Technology and Learning
University of Maryland

Dr. Bev Hunter, Lead Scientist, Program Manager of Education Technology Systems
BBN

Rick S. Normington, V.P. Education and Strategic Services
Pacific Bell

Dr. Joe Oakey, President Emeritus
Autodesk Foundation

Julie Packard, Executive Director
Monterey Bay Aquarium

Dr. Margaret Riel, Education Consultant
InterLearn

Dr. David Thornburg
Thornburg Professional Development Center

Dr. Steve Webster, Director of Education
Monterey Bay Aquarium

Leslie Doyle, Manager, SAVE Program
Silicon Graphics

Dr. Boris Berenfeld, Senior Project Director, Global Lab
TERC

Consultants

Peggy Healy Stearns, Software Instructional Designer

John Ittelson, CSUMB, Distance Learning

Bonnie Brunkhorst, consultant to review National Science Standards

Research

Dr. Trish Stoddart at the University of California, Santa Cruz, is conducting pedagogical research on the Virtual Canyon project. The purpose of her research is to examine how teachers' attitudes, beliefs, and practices change as a result of the Virtual Canyon project. The research will also look at changes in student attitudes toward school, science, and technology, and at how being involved in the Virtual Canyon project impacts their educational experience.

During Year 1 of the project, the research team collected a tremendous amount of baseline data on the six teachers participating in the design phase of the project. The baseline data consists of interviews, surveys, and classroom observations. In Year 2, the scope will broaden to include a closer look at the experiences of the students participating on the design teams. The research team will also survey and assess additional students and teachers who have not participated in the design and who will serve as beta test sites. Furthermore, each student population will be matched with a control group who will be assessed using the same instruments.

Not Just Another URL

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Key Words: **Internet, interactive instruction, URL, learning**

Internet technology provides a great potential to improve learning and teaching, as well as access to seemingly unlimited resources of information. However, will this new teaching tool start with a bang and quickly fade, like other technologies employed in the past? Perhaps a shift in focus from the technology to the question, "What do we want students to learn?", will avert this phenomenon.

When two departments at the Medical University of South Carolina decided to work together as a development team and design a course to be delivered over the Internet, a concerted effort was made to focus on learning, not the technology. As a result of this effort, the course was:

- based on learning strategies—A motivational context, a well-structured knowledge base, a high degree of learning activity, and interaction with others, were factors considered in the design of the program. The development team planned for other learning strategies, as well: providing opportunities for students to integrate parts of their learning into meaningful experiences, and encouragement to reflect on the goals of the course, the action taken to meet the goals, and the feedback from the learning experience.
- based on principles of instructional design—Analysis, design, production, and evaluation were critical components of the entire development process
- interactive—Requiring students to read static, text-based Web pages is not the purpose of this program. Providing an opportunity for students interact with each other and to take an active role in their learning are the critical components. In order to maximize time spent learning versus using the technology, a significant amount of time was spent on functions of the program and interface design.
- easily updated—As instruction is monitored and adjusted to meet students' needs, the faculty can access a password secure area to update content.

The Educational Technology Laboratory and the College for Health Professions at the Medical University of South Carolina consider the Internet a new teaching tool. Time spent thinking about the way in which people learn, the strategies that promote learning, and the way in which effective instruction can be provided, increases the methods by which this technology can assist students in becoming life-long learners.

General Session: New Curriculum Designs/Instructional Strategies

Land Use, Energy, and Human Impacts: Local Change in the Global Village

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Key Words: **Internet, elementary, secondary, GIS, networked communities, image processing**

Overview

The Earth System Science Internet Project (ESSIP) links 5th–12th graders, University of Wyoming scientists and science educators. The pilot phase of this project has resulted in the creation of six investigations which involve students in active learning about the earth's geosystems. Students, teachers, scientists and project personnel are currently engaged in piloting the activities in 16 Wyoming public school classrooms connected via the Internet. The activities focus on meaningful real world problems, involve the students in hands-on data collection and an exchange of ideas and collected information with students at other sites.

ESSIP Home Page

The Earth System Science Internet Project Web site serves as the hub for the activities included in the pilot module. It can be accessed at

http://www.uwyo.edu/essip/home.html

Menu options provide access to pictures of the students and their schools, a "Contact List," a library of hot links to related sites, and a teacher plan book selection which routes to detailed teacher instructions for the student investigations. Teacher plans include concept statements, a list of materials required, a description of what students do, content background, possible extensions and a resource section.

Investigations

The "Investigate" menu option takes students to a sub-menu directing their investigations. Currently there are six investigations provided. In the *Maps and Images of Wyoming* investigations, students can access aerial photographs of their city/town ranging from the 1940s to the 1990s. Aerial infrared images and TM data are also available for some sites. Students can download these images to analyze using an image processor. Students examine these images for changes over time and are challenged to devise a classification system for the land uses they can detect. Once agreement is reached they determine a percentage of the occurrence within their city of each of these uses (i.e. business, residential, transportation, recreation, etc.). Each site shares their land use results with other sites for comparison and contrast.

A second investigation is the *Global Energy* investigation which accesses the Defense Meteorological Satellite Program Operational Linescan System. Students compare the magnitude and number of lights between the United States and South America and hypothesize the causes for these differences. They then complete charts which require looking at information in the Arcview world data set. Students use this information to determine such parameters as per capita income, a technology index and population density. Next they look for correlations between the lights and the parameters to consider factors that influence the amount of light energy being used by a country.

In a related investigation, students learn about local, national, and global electrical production and consumption. The students make estimates and gather data about their home consumption, and then make predictions about their community use. Then, using community resources, they check their estimates. The same activity is done at the state and national levels. Data from the Energy Information Administration available through the Internet is used to check state and national estimates. The students also investigate electrical production in Wyoming. They contact the production facilities to learn about production costs, including human resources, natural resources, and transportation.

In the *Land Use Module* students use Global Information System software to explore 1:100,000 data at a county-wide level. Themes available for student investigations include landmarks, elevation contours, hydrology, land ownership, geology, land cover, animal habitat, and transportation. Students are challenged to look for patterns of land ownership, stream distribution, and land cover and share their discoveries between sites. Students use these themes to consider the implications of city growth and to propose a plan (with rationale) for expansion. Finally, students use this spatial database to design an advertisement for visiting their county. These advertisements are shared among sites on the Net.

Evaluation

Evaluation results will guide the revision of materials and activities. In addition, data is being collected to help explore questions such as "What types of support systems are necessary to help students form networked communities? What kinds of interactions do students have with peers located in other sites? In what ways? What kinds of interactions do students have with experts at other sites? Do these interactions enrich their learning environment?

Internet Poster Session

Beowulf to King Lear: Text, Image, and Hypertext

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Key Words: **Interdisciplinary, use of technology for study of literature, Web/HTML composition, student-constructed multimedia**

Summary

We will present our experiences team-teaching an interdisciplinary course combining the study of literature, history and art history with training and experience using computer technology. Content includes the classical works in early British literature, including Beowulf, Sir Gawain and the Green Knight, Chaucer's Wife of Bath, the Arthurian legends and King Lear. Our approach is to instruct, guide and require students to utilize technology for a variety of purposes, including some of their interactions with us and their peers, their research and reflection on the literature, and their presentations. In particular, the students design and create their own hypertext documents in the form of HTML pages. Our hypothesis is that the construction of multimedia invokes and increases subject matter learning. This has been consistently confirmed by our experiences. We have made use of student-constructed multimedia projects in a variety of settings; this particular course will have been taught twice by the time of NECC '97.

The construction of hyperlinks and the identification and juxtaposition of images and text requires student-authors to develop and express a deep understanding of the subject matter. The presence of their peers and teachers in the computer classroom constitutes an authentic audience for their work, unlike the usual situation in which only one teacher reads their papers. Because of the audience, because of the existence of impressive models, and because of the effectiveness of the tools, students generally devote considerable effort in the production and improvement of their work. The 'time-on-task' exceeds the norm for writing classes. An additional factor is that team teaching serves to de-center the classroom, providing an environment for students to take charge of their own learning.

We will present the course syllabus, schedule, materials, techniques for preparing students to do the work, descriptions of the logistics and support arrangements, and rubrics for grading. In addition, we will show student work and student reflections on the experience. The students who have enrolled include students from throughout the university; for example, English, Computer Science and Information Systems majors are all participating.

Certain factors make this effort of special interest to educators, even those with their own experience in classroom multimedia. This is a whole course, satisfying the university undergraduate requirement for a second level writing course, with an additional one credit of Information Systems elective. We will offer practical tips on how to organize and implement such courses. The course content is substantial and independent of the role of technology. However, since the content does involve examples of literature from distinct historic periods, the students are easily stimulated to reflect on 'new media.'

The team consists of Dr. Driver, currently engaged in a study of manuscripts for the National Endowment for the Humanities and a founder and chair of the Early Book Society and Dr.

Meyer, director of the core course in computer information systems and co-author of a textbook, Multimedia in the Classroom (Allyn and Bacon publisher). We look forward to sharing our experiences.

General Session: Technology Implementation/Educational Reform

Doing Research Using the Web

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Key Words: **Web research, critical thinking, evaluation of Web sites, Web/HTML composition**

Summary

The World Wide Web is quickly coming of age as our next mass medium, in the words of William Gibson, "the collective global mind." But the Web is also notorious for including sites that are unreliable, idiosyncratic, erroneous or simply worthless. The gems that are present on the Web may be difficult to find. It is also essential to appreciate that many sites on the Web are valuable because they are primary sources and not the product of standard scholarship. These aspects of the Web make many faculty members hesitant to encourage students to use the Web for serious research. Even those of us who are personally enthusiastic about the Web must ask the following question: can students make critical distinctions among Web sites and evaluate the kind of information provided? We decided to accept the situation as it is and turn it into a learning opportunity for our classes.

In this session, we will describe the 4 step process we have used in classes. This includes:

1. instruction and practice in Web browsing and Web search engines.
2. discussion and generation by the class of criteria for identifying useful sites and useful sets of sites for particular research topics. Students choose topics.
3. instruction and practice in the creation of HTML pages.

4. students produce a report in the form of a hypertext document (use of images and audio clips is encouraged) with evaluations and ratings of sites and links to those sites.

We will share the hand-out materials and describe the logistical arrangements that have proven efficient and effective. This is a practical module to include in courses and can be integrated with subject-matter teaching and learning. The so-called problems with the Web provide an environment for students to develop critical thinking skills and discipline-specific habits of mind.

We will describe our experiences with actual students in an English class and show both student work and students' reflections on the process. Students worked quite diligently on their projects. They were thrilled that they were not only users of the this thing that they read and hear about every day but also authors. The most gratifying aspect of our work was that for many of the students a 'transfer' of understanding appeared to take place. A student wrote: "I have felt that most printed documents are reliable because they were printed... Now I don't feel that way and I think from now on I will be more critical in assessing my sources." Last, we will describe our work with faculty. This will include how we help colleagues customize this approach to specific disciplines.

General Session: Technology Implementation/Educational Reform

Technology and Elementary Mathematics: A Lever for Change or Just Another Tool to Assimilate?

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Key Words: **mathematics, elementary, technology, reform, professional development, graphing software, data analysis**

The Model Schools project has been funded by the National Science Foundation to help the K–12 DoDEA schools (schools for dependents of US Department of Defense employees) in Hanau, Germany mesh the infusion of technology with their reform efforts. Since September of 1995 researchers and educators from TERC have been working with the schools' Planning and Implementation teams not only to plan for the expansion of the schools' technology infrastructure, but also to use that technology to enrich and deepen the learning experiences of *all* teachers and *all* students in the schools.

Tremendous possibilities for leveraging resources and commitment come with a broad-based effort such as this one, which involves all teachers and all students. But a number of constraints come with it, too. The Hanau DoDEA schools, like those in large systems around the country, are subject to the decisions and plans of high-level personnel who have decided that "technology infusion" must become a system-wide priority. The schools are left to make their way in implementing those decisions and plans. What does technology infusion actually mean for teachers, students and classrooms? What is the bridge between technology and curriculum that reflects the goals of school reform? How can technology be introduced in a way that will transform pedagogy, rather than merely being folded into ongoing practice? These are among the many issues that the Hanau DoDeA schools face as they seek to carry out mandates from the central office.

Though they receive periodic visits from some of the best professionals in the field, because of their geographical isolation the DoDEA schools stand outside of the school reform efforts stateside in many ways. Yet the DoDEA teachers share with their colleagues in this country a sense of profound separation between curriculum and technology. The Model Schools project's resources: a combination of readily accessible technology, increased opportunity for professional development, and exposure to research about technology driving changes in curriculum and expertise in gradual processes of change, make the Hanau schools an opportunity to shed much needed light on the interaction of technology and school reform.

We will focus this presentation on our evolving work with the schools in the area of elementary math: outlining our efforts to learn what members of the professional community at DoDEA have been doing at system, district, school, and classroom levels; discussing our efforts to make sense of technology's role in MathLand (DoDEA's adopted curriculum); describing this opportunity to link technology (graphing and spreadsheet software recommended by MathLand) with a content area (math) in our work with teachers and district personnel, building contexts that reach beyond the curriculum to challenge and stimulate adults mathematically; and telling the stories of a group of elementary teachers who have chosen these tools, and their evolving and very individual efforts to make them their own. Their approaches range from following MathLand's recommendations to the letter, to applying the tools to cross-curricular strands, to including students in their efforts to adopt the tool for classroom planning needs.

In particular we will highlight several questions: How much, in this project, is technology a lever for changing pedagogy? Does the fact that the tool is new and unfamiliar enable teachers to think differently about an element of math curriculum such as graphing (e.g., coming to understand that graphs can be powerful tools for exploring and deepening understandings of data; reflecting on the benefits and trade-offs of asking students to develop their own representations versus using technology to generate graphs)? Or does the tool just become assimilated into current practices? What does it take to help teachers stretch beyond "just using it?" What are ways to encourage processes of reflection as large numbers of teachers seek to incorporate new technologies into their practice?

General Session: Technology Implementation/Educational Reform

Organizational Support and Professional Development Toward Technology Use for Inclusion

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Key Words: **inclusion, organizational support, professional development, technology integration**

Many school districts around the country are currently undertaking reform efforts to improve the education of all students, including those with disabilities. As a consequence, a growing number of students with disabilities are now included or "mainstreamed" into regular classrooms. Key to successful teaching and learning in these classrooms is the use of technology in conjunction with careful planning and design of students' educational experiences. Technology can serve as an important tool in helping teachers to individualize teaching and learning. Computers, video, telecommunications, and a variety of assistive devices can make it possible for students with disabilities to gain access to and participate in a broad variety of educational experiences. However, the effective use of technology requires the careful design of appropriate learning activities. Educational experiences for individual students need to be customized to their particular needs and be consistent across the grades so that teaching and learning in one grade, including the use of technology, build the foundation for the next.

With funding from the US Department of Education, Office of Special Education Programs, researchers from the Education Development Center (EDC) are currently working with teachers and administrators from the Lawrence, NY Public School District on the *Pathways for Learning Project*. The goal of this project is to develop, demonstrate, evaluate, and disseminate organizational support and professional development strategies that promote the effective use of technology and curriculum planning to improve learning outcomes for students with disabilities in regular classrooms. The project is currently in its third year.

The core of the *Pathways for Learning Project* consists of several multidisciplinary teams of teachers and student support personnel working with school-based facilitators and researchers to design technology-based learning activities. A Pathways Team consist of teachers from several consecutive grade levels, administrators, and student support personnel such as resource room teachers, psychologists, and social workers. Pathways Teams meet regularly to develop learning activities that support the integration of children with disabilities into regular classrooms using a variety of technologies. An important aspect of the development of Pathways activities is that planning for a child in the sixth grade, for example, is shared by her current and future teachers, ensuring that successful strategies for targeted students would be carried over from one grade to the next, rather than each teacher having to piece together a new approach at the beginning of the school year.

The goal of this session is to explore, from the perspectives of the researchers, teachers, facilitators, and administrators involved in the project, several general themes that the project is addressing. These themes include educational reform, new curriculum designs, technology implementation, and new organizational structures.

Laura Jeffers and Babette Moeller, Researchers from the Center for Children and Technology of the Education Development Center, will provide an overview of the model for professional development and organizational support that we have been building in collaboration with the Lawrence School District, and discuss how this model evolved over the 3 years of the project.

TBN, Teacher at the Lawrence Middle School and member of a Pathways Team, will reflect on the team process and describe some of the activities and instructional designs developed by his or her team.

Karen Lazar, Teacher at the Lawrence Middle School and Facilitator of a Pathways Team, will reflect on her role as a facilitator, and discuss some of the professional development activities that were conducted with the teachers.

Mark Kavarsky, Principal of the Lawrence Middle School, will describe the kinds of organizational supports that helped to implement professional development and technology-supported classroom activities.

Babette Moeller, Researcher, will discuss results from ongoing formative research. The focus of the research has been on the impact that the project has had on students, teachers, and the school district.

General Session: New Organizational Structures

How to Manage School District Technology? The Case for a K–12 CIO

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Key Words: **technology management, Chief Information Officer, strategic planning, resource management, technology plan implementation**

Presentation Summary

As the Hackettstown (NJ) Public School district created a five-year district technology plan in 1992, it became clear that there was a need to appoint a technology leader for the school district. But where does such a person come from, and where in the organizational chart of the school district should this person sit?

Traditionally, in the K–12 setting, the person filling a position such as "Technology Supervisor" or "Technology Coordinator" was a classroom teacher who had developed an interest in computer technology (usually on his/her own) and who could be tapped as a resource for the entire school or district. It can sometimes become even more difficult to secure such skills in schools in states such as New Jersey, which offers no subject certification for computer technology. In this setting, "computer teachers" can hold certification in any of various disciplines—Business, Mathematics, Elementary Education are common. They typically do not have any formal training in the management of technology.

However, isn't the management of technology in the K–12 setting is really the same issue as in any other organization, public or private? The goal is to implement tools that enhance the achievement of organizational goals. Additionally, it is critically important to implement technology in such a way that you achieve the highest "return on investment." In business, this is generally more easily measured, but the objective is the same.

Traditionally, whether public or private, technology management evolved from the accounting function, and reported to the financial management side of the organization. An even more complicated model has often been found in higher education, where technology management may be split between a Director if Administrative Computing and a Director of Academic or Instructional Computing, with little coordination between the two.

Unfortunately, these models tend to create a situation where technology management has parochial interests that may prevent deployment of technology as a strategic enterprise asset. Additionally, the "users" in the organization know "on what side you're on" if technology management reports either to the Instructional or Business Administration side of the organization. In the business world, as well as in Higher Education, there has evolved an individual known as the "C.I.O.", or Chief Information Officer. This new position generally is considered part of the senior management team, often reporting to the CEO in business, or to the President in higher education. This individual, with responsibility for the articulation of technology implementation across an entire organization, is in a better position to work with all stakeholders of an organization, and to enhance the effectiveness of technology.

This presentation, discusses the evolution of the C.I.O. position in K-12 education, and the parallels with both higher education and industry. In particular, I will describe the organizational structure that has been created within the Hackettstown district. In 1993 the district adopted the C.I.O. model, and appointed a Technology Coordinator who reported directly to the Superintendent. The results of this organizational structure, both positive and negative will be discussed. Overall, this strategy has worked well in Hackettstown, and could offer a viable organizational structure for technology management and support functions in K-12 school districts of various sizes.

A summary of this presentation, including a copy of session handouts, will be available by June 1, 1997, at

http://www.gti.net/hackboe/boe/necc.htm

Spotlight Session

The Fifth Language: A Look Into Possible Futures of Technology in Education

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Key Words: **the fifth language, abstract science, future technologies**

Abstract

Speech, writing, mathematics, science, and "computers" can all be considered as languages. They are five major ways to represent, process, and communicate information. Writing and mathematics are were developed about 5,000 years ago, and led to the creation of our formal school system. Abstract science was developed about 2,500 years ago and lead to our current world of science and technology. We are on the verge of major changes in education that will be brought about thorough the computers, the fifth "language." This presentation will explore second order effects of the information technologies and some of the "far out" changes we might expect to see in education during the next 50 years.

General Session: New Curriculum Designs/Instructional Strategies

Designing Software With Thought to 21st Century Learning and Teaching Styles

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Key Words: **software design, multimedia, information design, educational software**

Description

The best of today's software and multimedia tools offer great opportunities for new and richer forms of learning and creative expression. They also have to be designed to support and encourage teachers and to appeal to a wide range of learning styles. When they work well, young people can regularly explore new ideas, relationships, and patterns not feasible before. They can think visually and metaphorically and use images and sounds, graphs and charts, and all kinds of representations to support and enhance their ideas. They can solve richly complex, multi-variable problems from multiple perspectives in a multitude of reasonable ways.

This panel will feature presentations by developers of some of the best current software products that illustrate through their quality a keen appreciation for teaching styles and learning styles. A moderated discussion, with audience participation, will follow.

Discussion

For years people like those on this panel have been thinking about how technology can support learning and teaching in ways that will help us all be more prepared for the 21st century. Criteria for judging quality educational software will demand attention to varied learning and teaching styles.

The new key element to education is that we must prepare young people for a range of careers and challenges that don't exist today. Learners will have to become aware of their strengths as learners and utilize these strengths to become efficient in learning, in grasping new concepts, in creating new ways to look at things. Software will have to support specific skills as well as strategies for learning new skills in general. New areas of learning such as information representation, information design, project planning, implementation and collaboration must become key to the curriculum. Software designers must create new models of the user experience so that with their software "young people can regularly explore new ideas, relationships, and patterns not feasible before. They can think visually and metaphorically and use images and sounds, graphs and charts, and all kinds of representations to support and enhance their ideas. They can solve richly complex, multi-variable problems from multiple perspectives in a multitude of reasonable ways."

Panelists will show examples of software that demonstrate these issues and bring up the design considerations around the examples.

A lively discussion during the last portion of the session will include issues such as:

- How can design help users become more aware of their own learning styles.
- What new design issues will arise as we look towards creating software that can be delivered over the Internet and evolve in its design due to the benefit of continual user feedback?
- How can multiplayer game and chat technologies be used to enhance collaboration capabilities in future educational software?
- As schools become "wired" how can teachers and students become an integral part of the design process?
- How can the Internet in conjunction with quality software be used to give a generation of teachers a strong vision of potential technology use all areas of the curriculum?
- How can we take advantage of the vast content resources from educational television, movies and other high production media to use as the basis for quality content products?

General Session: New Curriculum Designs/Instructional Strategies

Technology: An Essential Tool in Teaching and Learning Mathematics

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Key Words: mathematics, problem solving, connections, reasoning, communication, calculators, computer software

The NCTM Standards have been available since 1989 with a vision for 21st century learning and teaching of mathematics. Educational goals include the importance of students becoming problem solvers, being able to communicate and reason mathematically, and being able to make mathematical connections. An essential tool in preparing students for this vision is technology. How we teach and learn mathematics must change to match the way mathematics is developed and learned in the 21st century.

This session focuses on learning and teaching mathematics using technology as an essential tool. Explore geometric concepts using Geometer's Sketchpad; develop and test conjectures about relationships through graphical analysis and interpretation; investigate problems using calculators emphasizing the importance of estimation. Instructional strategies with these ideas (and many more) are described to assist educators in embracing the vision of the 21st century with technology as an essential tool.

Paper Session

Integrating Computer Technology in Teaching and Learning: A Systemic Problem

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Key Words: **technology coordination, technology infrastructure, organizational structures, technology integration in teaching and learning, collaboration, partnerships, K-12**

Abstract

Project CONNECT (Connecting Oregonians: Navigating Networks of Educators with Computer Technologies) was a comparative study of two district approaches to achieving systemic change for the integration of technology in K-12 education. Results indicate that integrating computer technology in teaching and learning requires a systems approach in which specific factors are recognized as important in facilitating systemic change. Professional development must be considered in terms of the teachers' positions (grade level and subject) and must be focused on curriculum and instruction rather than the technology. The administrative and technological support systems within the district must be coordinated, ongoing, and available both school-wide and district-wide. When all of these elements are carefully planned and delivered, systemic technological change is facilitated.

Systemic change, according to Fullan (1993), is an unknown journey, where problems are our friends, seeking assistance is a sign of strength, simultaneous top-down bottom-up initiatives merge, and where collegiality and individualism co-exist in productive tension. Fullan poses that the basic tenant of systemic educational change is to understand and address the interrelationships of all the components that make up the system. One change affects the entire system. Likewise, systemic change can not be successful in education without addressing the many factors that make up the system. As educational systems respond to the impact of technology on education, the many factors that make up the educational system (pedagogical, economical, political, historical, sociological) interact and thus either inhibit or facilitate systemic change. Specifically, with respect to the integration of technology, the change process must recognize and support the teachers, the pedagogy, the instructional content, the curriculum, professional development of teachers, technological teaching and learning tools (the hardware and software), the technological infrastructure (connectivity within the classroom, the school, the district and the world outside the district), and the political infrastructure (the administration of the system).

Little is known about the factors that facilitate or inhibit systemic change needed to successfully integrate technology into the teaching and learning process. Evidence abounds that it is not sufficient to work in a piece-meal fashion by placing computers in a classroom and assuming that systemic change will simply happen because the world is technologically connected. This approach ignores the systems approach. As Senge (1990) warns, what is needed for systemic change is a fundamental shift in our thinking about educational change itself.

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Recognition and consideration of the whole school system is essential for any meaningful systemic change with respect to the integration of technology into teaching and learning.

This study was designed around the theory that, to provide systemic technological change in school districts, a systems approach is required, an approach that deals with teachers as part of school and district staff, with the technological support of teachers and schools (the technological infrastructure), and with the organizational management of the schools and the district (the political infrastructure). Ultimately this framework deals with changes in teacher attitudes, teacher and learner roles, classroom environment/climate, teaching methodologies and strategies, the goals and curriculum of the district as well as changes in the technological and political structures within the district. The question for this study was to identify factors that specifically facilitate (as well as inhibit) systemic change to integrate technology into the teaching learning process.

The primary objectives of this research project were: (1) To design a professional development model to meet the demands that teachers face in redesigning what and how students learn when integrating computer technology into instruction; (2) To develop a model for systemic change for school districts that encompasses the technological, pedagogical and political structures inherent in the system as teachers begin to integrate technology into the teaching and learning process.

Method

Project CONNECT (Connecting Oregonians: Navigating Networks of Educators with Computer Technologies) was a comparative study of two approaches to achieving systemic change for the integration of technology in K–12 education. Two public school districts were selected to participate in a two-year program focused on the development of district models for meeting the demands and challenges teachers face in redesigning what and how students learn. Each district identified model schools (one elementary, one middle and one high school from District A and two elementary, one middle and one high school from District B). Each school was provided five state-of-the-art multimedia computer workstations and educational software (i.e. connectivity, presentation, multimedia, word processing, spreadsheet, database, World Wide Web, and HTML/hypermedia) for each model school. The school districts were responsible for insuring that the workstations were connected to the Internet and the World Wide Web and for providing electronic mail access for the project participants in the technology-enhanced classrooms.

Teams of two or three teachers were identified from each school for leader training; in total each district identified nine teachers for the leader training. Each district also selected one administration level representative to participate in the project and provide the leadership for the district. During the first year of the project, leader teachers participated in extensive technological and pedagogical training on the integration of technology in the teaching and learning process; specifically, they participated in a six-week summer session in the university state-of-the-art multimedia laboratory and 15 day-long follow up training and support sessions throughout the following academic year. Additionally, each teacher selected a student to work with for two weeks of the summer training and to prepare the student as a teacher's assistant in the new technology-enhanced model classrooms in their own schools.

Following the summer training, teachers returned to the districts to begin integrating technology in their instruction. A variety of approaches was used by the teachers. In one school (elementary), the five workstations were placed in a single classroom and only one teacher was able to focus on integration of the technology in education. In one school (middle) the technology was placed in a lab situation and teachers were allowed to bring their classes to the lab when they wished to have the students work with the technology. And, in the remaining five schools (elementary, middle, and high), the workstations were distributed among the teachers in the project. These leader teachers were supported throughout the year with monthly meetings designed to provide assistance as they dealt with issues of integrating the technology. These support meetings provided time for teachers to share their efforts as well as ask questions of each other. Throughout the year, the most popular requests for consideration at these meetings were (in order): (1) troubleshooting hardware and software, (2) learning to use new parts of the software, and (3) learning about other software. The meeting organizers also considered curricular and instructional issues but these issues were not primary issues for the teachers because they dealt in generalities of the K–12 grade levels and subject areas. A second support for the teachers was maintained through weekly journal requirements. Teachers were asked to submit weekly progress reports responding to specific questions. Project leaders responded to each e-mail, providing information, directions for finding solutions to specific problems, and encouragement.

The intent of the second year of the project was to have the districts begin to assume responsibility as well as expertise for technology training. Therefore, in the final three months of the first year of the project, the leader teachers were formed into district teams to design a training session for the professional development of an additional nine teachers in their district. This training was built upon a one week training session provided for the 18 new teachers (from the two districts) on the university campus. The remainder of the training was designed and provided by the leader teacher teams in the two districts both during the summer session. The leader teachers were also expected to develop a training manual for their district that would be used by the district in future training of teachers.

Following the summer training, the leader teachers were expected to provide training and support for the new teachers. Only three meetings throughout the year were provided by the university partner for the entire group of teachers (leaders and new teachers). Each district team identified the type of training and support for their own districts for the school year. One district used a centralized model while the second district used a mentor model in each school. Journals were required of all teachers (leader and new) monthly in which they were asked to respond to specific questions. As with the first year, project leaders responded to each e-mail, providing information, directions for finding solutions to specific problems, and encouragement.

Both qualitative and quantitative data sources were used to compare the participating teachers and the two district approaches and to identify factors influencing systemic technological change. Quantitative data sources included pre- and post-training questionnaires administered all teachers (leaders and new) to assess their technological knowledge and skills.

Qualitative sources included:

1. Journals: Throughout the study the teachers (leaders and new) were required to submit an electronic journal to the researchers reflecting on their experiences and their students' experiences. Journals were systematically reviewed by the researchers to examine the continuing problems and perceptions of the participants (both individual and systemic), project benefits, needs of the participants, and to determine whether technology was being integrated into the participant's teaching and the students' learning. Administrative participants were also asked to provide monthly journals reflecting on the district experiences and their interactions with the teachers. Follow-up electronic mail and phone requests were made when the journals were not received.
2. Site observations: Site visits were conducted at each school during the two academic years to video classroom activities where the schools had located the computers. Site visits were used to corroborate the researchers' developing assessments of factors supporting or inhibiting the integration of technology in teaching/learning process.
3. Interviews: Each teacher and administrative participant in the project was interviewed at least twice throughout the project. The interview protocol asked the teachers to explain how they had integrated technology into their teaching and student's learning or how they supported other teachers in their school and district. They were also asked to reflect on the problems that they had in integrating technology into the teaching and learning process or in supporting this process. Administrative participants were asked to identify the district commitment to the integration of technology, to identify evidence

of the commitment, and to discuss the problems in the integration of technology from a district perspective.

4. Professional development and support meetings: Project meetings and professional development sessions during the summers and academic years were recorded, transcribed and analyzed to better understand if the professional development significantly improved the teachers' ability to integrate technology into the teaching and learning process, and whether systemic change was taking place in the way technology was being integrated in the teaching learning process in each of the districts.

All data sources were compared to identify the effects of the professional development training and the two approaches to integrating technology taken by the different districts. Comparisons determined factors influencing systemic change supporting integration of technology into the teaching and learning process.

Results

The results of the study indicated that a specially designed professional development process can change teachers' attitudes regarding the integration of computer technology into the teaching and learning process from suspicion to a positive "I can do that" attitude, assisting teachers with learning the role of facilitator and guide (moving away from the expert-novice model), and initiating changes (i.e. updating) in curriculum and subject content. The analysis also supported the notion that technology-centered professional development must be an ongoing and long-term process. Ongoing support systems must be established to address instructional content, pedagogy, technical support and troubleshooting, human networking, electronic networking, and infra-structural development.

A second factor identified from all the data sources was school level. Elementary school teachers were far more apt to make changes in their curriculum and instruction than were secondary school teachers. Investigation of this factor indicated that the elementary teachers enjoyed a sense of freedom for making changes and the secondary teachers felt a responsibility for meeting "the established requirements" of the subject.

Results also clearly demonstrated the administrative and technological infrastructures are fundamental to systemic technological change. In the two cases from this study the administrative support and technological infrastructures were significantly different. As a result, one district was able to provide a centralized support model in which both administrative and technological support were provided. In the second district, the administrative support came from individual principals rather than district resources. As a result, the leader teachers used a mentor model of support, with individual teachers working within a school rather than across the district. Comparison between these differences provided important information regarding the administrative and technological factors needed before teachers are able to successfully sustain the integration of computer technology into the teaching and learning process. These factors included resources, administrative commitment, priorities, goals and vision. A model for systemic change requires that these factors be addressed and the appropriate infrastructures established. Without addressing these factors, individual change can happen, but systemic change will not.

Discussion

In order to successfully integrate computer technology into a school district's teaching and learning process, systemic change is required. The systemic change requires that top-down and bottom-up initiatives occur simultaneously. The change requires specially designed professional development that concentrates on the integration of computer technology into the teaching and learning process and not on the computer alone. Content and context must grow together. However, an important aspect of this professional development is an analysis of the curricular goals. Teachers and administrators must consider those goals in light of the capability of the technology. Technology changes what must be learned as well as how it must be learned.

Teachers and administrators need to redesign the curriculum based on this understanding. The administrative infrastructure is a key factor for successful systemic integration of computer technology in a district's teaching and learning system. The administration must be involved in and support the changes in the curriculum and the instruction. But the changes can not be only top-down. The teachers must be involved in the changes. On the other hand, the teachers can not make the changes without the support of the administration.

A second important consideration for professional development deals with the packaging. When the professional development focuses primarily upon the hardware and software capabilities for making changes, teachers focus on those aspects. Yet, the results of this research indicated that the focus should be on the curriculum if teachers are to integrate technology in teaching and learning. This recommendation directs the audience for the programs. Programs must be provided for elementary teachers where the focus is on multidisciplinary. Programs must be provided for secondary teachers by subject matter so that teachers have the opportunity to specifically consider their own subjects with respect to integrating technology. In order for teachers to make specific changes, they must be provided the opportunity to consider their specific teaching assignments and changes in that curriculum.

Finally, the technological infrastructure of a district must be stable, supported, and ongoing. This infrastructure must be more than a district office or person. Teachers must be supported when they are using the technology in their classrooms. Problems with both hardware and software happen when they are teaching. They need some professional development in handling immediate problems. But, they also need assistance in troubleshooting problems. They can not be expected to be the experts with the technology but they must have access and support in their school. The mentor model identified by one district met a need but was missing the district support personnel. The district model identified by the other district met a need but was missing the individual school immediate needs.

In essence, integrating computer technology in teaching and learning requires a systems approach in which specific factors are recognized as important in facilitating systemic change. Professional development must be considered in terms of the teachers' positions (grade level and subject) and must be focused on curriculum and instruction rather than the technology. The administrative and technological support systems within the district must be coordinated, ongoing, and available both school-wide and district-wide. When all of these elements are carefully planned and delivered, systemic technological change is facilitated.

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General Session: Improved Productivity/Administration

Running a School Online Dramatically Improves Productivity and Administration

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Key Words: **online, productivity, Lotus Notes, high school, collaboration, administration**

Eighteen students ask for schedule changes. Three teachers assign homework to their classes. Two other teachers collect projects from each of their students. The school secretary reminds 22 students to return their registration forms. A teacher, during her prep period, revises an upcoming lesson plan. An administrator informs the entire student body of an upcoming school event and an ad hoc student group petitions the same administrator to lengthen the lunch period.

A typical day at a high school? Not at New Technology High School (a public high school in Napa, California) where all of these activities occur virtually instantaneously online.

Running a school online represents a paradigm shift in learning opportunities, school management, responsiveness to students, and using the methods of the workplace in public education. After years of research and advice from high-tech businesses, Lotus Notes, widely used in the business world, was chosen as the online operating "platform" for the new school.

At the school this "group ware" is used in a variety of ways. Some examples:

- Students, teachers, and administrators communicate concerning such issues as absences, schedule changes, requests for information about college, and student family problems.
- Students submit homework and receive assignments/homework evaluations from teachers.
- Students work in "electronic groups" to develop projects.
- Students participate in the school's student government by sending their comments and questions directly to their student representatives.

- Staff and students access the vast resources of the Internet.
- Students communicate with their "online mentors."

Running the school online has cut student traffic in/out of the school office by over 80%. It permits a written record of all communications yet all students are heard and all students are responded to. In addition, students are learning and doing their work in a manner very similar to their future employment in high tech, high wage jobs.

General Session: New Curriculum Designs/Instructional Strategies

The Civil War: The Second American Revolution

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Key Words: **Civil War, curriculum integration, history, language arts**

The study of history to many students is the study of the dead past. These students do not understand and appreciate the struggles of their ancestors. Thus there is no understanding of the dynamics that continue to shape their lives today.

Innovative integrated Language Arts, Social Studies, and technology curricular units allow students to gain a much greater appreciation of both their own history and American History. These units can combine computer simulation, multimedia, video, research (on- and offline), writing, speaking, and reenactment.

The third of three units involves the American Civil War. While students study the events leading up to and occurring during the Civil War in history class, they read the historical novel *Rifles for Watie* by Harold Keith in language arts class. Through its hero, Jefferson Davis Busse, they vicariously experience the excitement, tragedy, and irony of the Civil War. The student's experience is enhanced in the two classes by viewing videos ranging from documentaries to Gettysburg. The experience is not just vicarious, however. Students will also be involved in a U.S. Senate debate simulation, a slave auction simulation, and a Civil War simulation. Students utilize CD-ROM and multimedia activities in preparation for some of these activities and as part of their studies. They can become involved in battle through a computerized Civil War game competition.

Howard Gardner's multiple intelligences work is utilized in The Civil War: The Second American Revolution unit through the numerous learning styles addressed and in the students' Civil War unit research project. Students can choose from a variety of research and product modalities including primary source research, on- and offline research, formal essay writing, fiction writing, drawing, modeling/ sculpting, dramatic writing and live or video production, game creation, and multimedia production to list a few. Many students combine another product type with multimedia because of the great flexibility it offers in presentation.

The previous unit (presented at NECC '96) was about immigration and the student's own genealogy. Continuity between the two units is achieved through the student's continuing investigation of their ancestry (if in the U.S. in the 1860s) or by following their 1840 Irish Immigrant simulation family throughout the Civil War period.

These integrated units allow the student to become more involved with the conflicts and controversies of the past (as opposed to the "hard facts") and encourages recognition and identification of their own heritage. History becomes the story of the struggles and cares of real people like themselves. Students can thus be empowered to learn from the past to better interact with the dynamics that daily affect their lives.

General Session: New Curriculum Designs/Instructional Strategies

Using Multiple Intelligences Theory and Brain Based Research to Design Technologically Integrated K–12 Curriculum

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Key Words: **integrate the K–12 curriculum, multiple intelligences theory, brain based research, new curriculum designs**

Description

Commercial educational classroom software and useful Internet addresses are becoming readily available to K–12 classroom teachers. Teachers now engage students using a variety of software and the Internet and may even share their lesson plans with other teachers through Web sites such as Teachers Helping Teachers at http://wwwx.pacificnet.net/-mandel. Students are very interested in lessons which use the Internet and the commercially produced educational software, particularly when participation requires interaction, discussion, and movement.

Re-organization of the K–12 curriculum is needed to integrate multiple intelligences theory and brain based research with the commercially produced education software and the Internet. While numerous teachers are creating exciting lesson plans using educational software and the Internet, those lesson plans are often isolated from the rest of the curriculum and do not take into account what we know about student learning using the multiple intelligences theory and brain based research.

The presenters will share their experiences and show a multimedia presentation with examples of integrated technological classrooms using the multiple intelligences theory and brain based research at various grade levels and in various disciplines. Comments from students who have been learners in this type of environment will be included. Successful professional development ideas will also be shared. Participants will receive a listing of written examples that specify forms of integrated curriculum that can be used in the classroom.

Paper Session

Technology and Collegiality

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Key Words: **technology, collegiality, Internet, World Wide Web**

Abstract

Using technology in a school/school district will foster the collegiality necessary for sustaining enthusiasm for teaching and will contribute to the professional development of each teacher.

Neil L. Rudenstine, president of Harvard University, began a recent essay in **The Chronicle of Higher Education** (February 21, 1997: A48) with the question: "Is the educational promise of the Internet real?" His answer exactly matches our thoughts. We agree that "the Internet enhances the vital process of 'conversational' learning." We believe that the use of the Internet can be effectively applied to the K–12 setting and be used to end the isolation and loneliness that causes many to leave the profession before their sixth year of teaching (Ponessa 1996, 3). Further, we believe that the Internet can be used to satisfy the documented need to share teaching experiences with others (Schulman 1988) and to receive the frequent feedback needed to improve teacher satisfaction and teacher performance (Glickman and Bey 1990; Goldhammer, Anderson, and Krajewski 1993).

Using the Internet to Establish Collegial Relationships

Models for the use of the Internet were first established at the college and university level. Opportunities are routinely provided for undergraduate and graduate students to use the Internet as a part of the on-campus instructional process (Fiess 1994) or as a distance learning model where courses are offered online through computer-mediated instruction (Reid, 1997). With the advent of the new NCATE (National Council for the Accreditation of Teacher Education Standards 1994) standards, most teacher preparation programs now include training in the applied use of the Internet for instructional purposes, while some include a student teaching experience that involves communication with a college supervisor and cooperating teacher using e-mail (O'Neill and Coe 1996).

In a very short period of time, K–12 educators have learned to use the Internet to incorporate shared information into the curriculum and daily instructional activities, communicate and establish collegial relationships within the school district and with other teachers, college/university professors and, businessmen throughout the nation. It is common to see 10th grade students doing an interactive frog dissection using the Web (http:/curry.edschool.virginia.edu/~insttech/frog/home.html), or teachers giving technology-mediated presentations (Azarmsa: 1997) in K–12 classrooms. Some high schools are actually providing online college preparatory courses for students throughout the nation. One example can be found at Cyber High School (http://www.webcom.com/~cyberhi).

Exciting partnerships have been established and communication is rapidly expanding. For example, the Public Broadcasting System has established Mathline, and more than 2500 teachers from 35 states communicate about math lessons (Checkley, 1997). Not only do teachers share ideas for exemplary lessons, they discuss new ideas for presenting effective instruction.

Teachers who have access to e-mail or the Internet can communicate with other teachers nationwide (O'Neill and Coe 1995). One example is found at The Teachers Network (http://www.pacificnet.net/~mandel/index.html). Another can be found at one of the oldest sites online—Web66 (web66.coled.un.edu/). Using the Yahoo (Braun 1996: 2752) World Wide Web search engine will yield other sites. Sample lesson plans and chatrooms can be found for teachers at all grade levels and in all subject areas.

Staff development through inservice has long been an accepted vehicle for sharpening and increasing the professional skills of teachers. If technology were used, communication with the staff developers from college and universities would be increased and the contact would no longer be limited to the day of the inservice training, or to the planned series of seminars. Partnerships between colleges and universities and school districts are growing (Gibbs 1996) and those collaborative relationships (Meier 1966) will be even more exciting when the teachers and college professors can communicate regularly through chat groups. For an example, try the Math Forum (forum.swarthmore.edu). Lesson plans and resources are provided for addition and subtraction, algebra, geometry, and trigonometry. More examples can be found at the 21st Century Teachers Initiative (www.21ct.org) or National Foundation for the Improvement of Education (www.mfl.org).

Interesting uses of the Web can be explored by contacting teachers at the La Fiesta School, Sonoma County, California, Trinity Lutheran School, Newport News, Virginia, and Oxbos Creek Elementary School, Champlin, Minnesota (Santo: 1997). Teachers, students, and/or schools have created Web sites to describe their projects. Numerous books and articles have been written to help teachers begin designing their own Web page, but Yahoo! Internet Life Surf School, Y-Life's Surf School (www.yil.com/filters/surfjump.html) is a helpful online resource.

Using the Internet to Involve Students

Teachers may decide to enter their students in collaborative projects. One example of an existing collaborative project is the Globe program which includes current environmental projects (http://www.globe.gov/). Information about beginning a collaborative project can be found at: Nick Nacks: Collaborative Education on the Internet (http://www/.min.net:80/-schubert/nicknacks.html.).

Another interesting site is The Why Files (whyfiles.news.wisc.edu). The National Science Foundation sponsors this site and students can find out about science that is in the news.

Teachers may decide to use the Internet in their classroom and use the endless sources of information. CEARCH Virtual Schoolhouse (http://sunsite.unc.edu/cisco/schoolhouse.html) contains the Cisco foundations's archive of links to numerous K–12 resources. Resources specifically designated for gifted students may be found at http://www.eskimo.com/!user/kids.html. Information about worms and cockroaches can be found at The Yuckiest Site on the Internet (www.mj.com/yucky). The Smithsonian site (www.sl.edu) is a treasure trove of interesting information for students and teachers (Baker, 1997). A high school student has created WebLit (www.rust.net/~rothfder/weblit.html) to allow students to access many links to various literature sites.

Conclusion: Using Technology to Foster Collegiality

Sharing classroom experiences, new ideas, and information with colleagues is essential for sustaining the enthusiasm of teachers. Today's technology allows teachers to communicate frequently with other teachers in the same building, other teachers within the school district, and other teachers nationwide. Connections can be made with college or university professors. Teachers and students can work together to find and use information. The possibilities are endless but the good news is that teachers no longer will be isolated in their individual classrooms.

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Spotlight Session

An Extended Vision of Project-Based Instruction Through Multimedia and Networking

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Key Words: **multimedia, networking, project-based**

Modern multimedia provides incredible opportunities for constructing a new, different, and very exciting form of project-based, performance-oriented curriculum. Combining these opportunities with those newly available through the Internet adds extensive resources, immediacy, and longevity to any curriculum endeavor or learning engagement. It is not an exaggeration to say that multimedia and networking are reshaping what we mean by curriculum and how and what we expect students to learn. Indeed, they are helping to reshape our vision of education. This presentation will describe with illustrations some of the key factors that make the combination of multimedia and networking so powerful.

The Attitude

Assuming an optimistic attitude toward the learner is an important foundation.

Appealing to strength. Students have more capabilities to make sense of their world than traditional curriculum acknowledges. Multimedia curriculum can effectively engage a range of sense-making capabilities

Assuming some cultural knowledge. Rarely do students need to start from the very beginning in understanding something. They bring to school much knowledge of the world, which, though incomplete and full of misconceptions, provides an important place to start.

Allowing questions to form. Learning proceeds most effectively when students are given a chance to form and sharpen their own questions before undertaking the search for answers. It is always the case that participation in the process of problem definition leads to a fuller understanding of what a solution means and why it makes sense.

The Content

The content—the food for thought—needs to be rich and complicated enough to engage the mind and promote real understanding.

Providing sufficient contextual richness for sense making. Leo Tolstoy once pointed out that the student's mind actually thrives on richly detailed contexts with complex relationships; they support the process of making sense rather than inhibit it. Current cognitive research on situated learning is confirming this. It is important to go well beyond providing just the information needed to solve a problem; one must provide sufficient information to comprehend fully both the problem and its solution.

Going deep into data. There must be data from many resources—newspapers, books, maps, reports, surveys, observations of still or video imagery, interviews, etc. The best data is real data, not pre-processed information. With real data and original source materials, students can truly be scientists, historians, mathematicians, etc.

Using story as integrating and structural thread. Story is one of the most powerful knowledge-structuring devices we possess. Through hearing authentic stories and becoming proficient at telling their own, students learn how to make sense in a social context.

The Approach

Identifying with one person's coherent and caring perspective. Hearing and seeing how competent professionals care about their work helps students appreciate the care needed to understand something well and share it effectively with others

Becoming surrogate investigators and problem solvers. Learning about how a competent person thinks about a particular problem situation in his/her world is a critical habit of mind. The knowledge and skills required for effective problem solving should not be separated from the people who use them to understand their world. Furthermore, there is real pedagogical value to be derived from being a virtual apprentice.

The Technique

Creating engagement heightened through sensory awareness. Multimedia enables the creation of materials that appeal to a full spectrum of student interests and abilities, intelligences and learning styles. It can provide multiple entry points so that no student needs be left out.

Seeing purposeful imagery. The purposeful use of well conceived imagery can promote understanding of complex phenomena. Multimedia, with its capability to juxtapose pictures, animated and still graphics, and video provides incredible opportunities to use imagery more purposefully for furthering learning.

Encountering representational diversity. Most interesting aspects of life gain in richness when perceived from multiple perspectives and in multiple representations. The use of visual and auditory information, combined with text and data, open up for many learners the possibility of approaching information from their own preferred learning style.

Employing technology tools *in situ*. Once a problem has been defined, then the student should be able to work on its solution without having to leave the problem context. Context-embedded tools enable students to explore and manipulate data and to solve problems where they find them.

The Goal

Finding truth in the gray matter. We are discovering that real understanding is achieved when students begin to understand the competing perspectives that surround almost any interesting problem in our world. We've called this "living in the gray," by which we mean that

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the end of an investigation is rarely a clear answer, but more likely a deeper awareness of a set of issues and the controversies surrounding them.

Finding a lifelong quest. It is now possible to expand the richness of a multimedia environment (where appropriate connectivity exists) to embrace the rapidly expanding resources of the Internet and its capacity to provide the learner with current information and data and linkages to a community of learners that could potentially continue for a lifetime.

Internet Poster

Community-Based Student Projects: Frank Lloyd Wright on the Web

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Key Words: **Internet, Claris Home Page, multimedia, student projects, community-based, QuickTime VR**

Description

The Dana-Thomas House, a Frank Lloyd Wright designed residence, is the focus of student multimedia projects. This Web site exemplifies community-based student work.

Abstract

The methodology of creating student projects has changed over the years. Poster board and oral presentations have been replaced with multimedia projects created with the technology available to students today. The presentations are more visual and interactive through the use of these new tools.

No matter how advanced the presentation method, though, the best content for student projects is still information that hits close to home. Local historical sites, home-grown heroes and the history of your town are perfect fodder for student projects.

Located in Springfield, Illinois, the Dana-Thomas House, a residence designed and built by Frank Lloyd Wright in the early 1900s, is one of the architect's most renowned Prairie Style homes. Several teachers in the Springfield School District have used this historical site as part of their units of study over the years. Incorporating the study of architecture into their math, art, social studies and language arts lessons, teachers have developed thematic units of study. "Using architecture in a thematic unit is one way to integrate all subject areas of the curriculum into a meaningful learning process. The far-reaching skills carry students through their lifetime!" says Siri Hartsfield, former sixth grade social studies teacher, currently working for the District as a curriculum developer and advisor.

In the past, the Springfield School District students have used software packages such as HyperStudio™ or Kid Pix Slideshow™ to develop multimedia projects which explore and discuss the content of their architectural studies. With the recent development of a District Web site, however, students have now started developing their multimedia creations with Web page development software and have published their work on the World Wide Web. Students using Claris Home Page™ create multimedia projects that are presented with Netscape Navigator™. These projects are usable from a disk, a local hard drive, the school's server or they are posted to the District's World Wide Web server as part of the school's Web site.

Recently, the Dana-Thomas House Foundation Board of Directors voted to commission a World Wide Web site on the Internet for the Dana-Thomas House. This Web site includes a section of information "from a kid's point of view." Student work related to the House, Mr. Wright or architecture in general can be added to the site by contacting the Webmaster. This Web site contains student projects created by Springfield District 186 students.

The site's URL is http://www.springfield.k12.il.us/dthpages/dthhomepage.html

Paper Session

Teachers' Perceptions About Computer-Enhanced Writing: A Reality Check

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Key Words: writing, workshop, survey, multimedia, support, Internet

Abstract

Writing teachers in a regional survey were confident that computers could help them teach writing, yet their knowledge of the latest technologies and their access to computers generally was limited. Experience in two summer technology workshops showed how writing teachers could quickly overcome the limitations of their knowledge and envision computer enhancements to all phases of the writing process.

Introduction: Emerging Technology for Writing Instruction

Writing teachers have come to appreciate the value of computers in enhancing their ability to help their students write well. Both the familiar technologies such as word processing and newer technologies such as multimedia and the Internet can be useful in writing instruction, teachers reported in a recent survey. However, there is a gap between what teachers say they value and what they actually can use in their schools. The gap is one of both resources and knowledge: teachers often lack access to the hardware and software they would like to use, or they are only somewhat knowledgeable about the potential uses of newer technologies in writing.

To conduct a "reality check" on the many claims being made about the value of technology in writing instruction, the authors designed a study to gather information about the following questions:

- How well are schools equipped with the new technologies?
- How well-informed are teachers about new technologies for writing instruction?
- How comfortable do teachers feel about using various technologies in writing instruction?
- How do teachers use existing computer facilities in writing instruction?

Two Summer Workshops and One Survey

Formulation of the problem began during two full-week summer writing workshops for teachers sponsored by educational publisher Prentice-Hall in 1994 and 1995. The workshops were intended to introduce teachers to a prototype comprehensive multimedia software resource for writing instruction, and also to provide realistic feedback about the prototype to the software developers and the publisher. During the workshops, as the teachers explored and critiqued the multimedia program while using it to produce short pieces of their own original writing, the authors asked questions about what they valued in such a program and how, in general, they felt computers should be used in writing instruction.

In the workshops, 39 middle and high school teachers from five Midwestern states explored ways to teach writing using computers. Their hands-on experience with a CD-ROM-based program allowed them to make many comments and suggestions, some of which they provided in writing at the end of the workshops. In informal discussions also, in which teachers interacted with each other, with the authors, and with representatives of the publisher and the developer, they commented on such things as how to organize computer use, how to enhance writing assignments with computer technologies (e.g., desktop publishing software), and what they wanted in a computer program for their class. We asked teachers to indicate how many years they had been using computers in writing instruction and what they thought their students needed most in writing instruction.

The Survey

On the basis of these teachers' formal and informal comments, the authors developed a 28-item survey instrument that was piloted with five educators and then administered to the first summer's workshop participants and to 608 randomly selected English teachers throughout southeastern Wisconsin, for a total of 630 questionnaires. In the survey, teachers who identified themselves as teachers of writing indicated their perceptions about the value of computers in writing instruction, their own use of computers in writing instruction, and contextual factors affecting how they used computers, such as perceived degree of administrative support. A total of 224 teachers responded, for a response rate of about 36%.

Teachers' Experience With Computers

The teachers who responded represented all levels of experience teaching writing with computers. Fifty-five teachers, or 25% of the respondents, considered their computer skills to be either advanced or expert. When asked to characterize their experience using computers specifically to teach writing, 110 of the respondents (50%) stated that they had had at least moderate experience teaching writing with computers. This suggests that using computers to teach writing has gained popularity in the schools, although most teachers report that they lack good computer knowledge and skills.

Teachers with fewer years of teaching experience reported having a higher level of computer skills than did those who had more years of experience. As shown in Table 1, 39% of the teachers with fewer than 10 years of experience rated their computer skill level as "advanced" or "expert," whereas 21% of teachers with 10–20 years of experience rated themselves advanced or expert, and only 17% of the teachers with over 20 years of experience reported that they were advanced or expert computer users. However, as indicated in Table 1, it was more difficult to distinguish the three experience groups on the basis of whether they had had any experience using computers to teach writing.

Table 1: Teaching experience and the use of computers for teaching

Years of experience (in Years)	n	Rated self "advanced" or "expert" using computers	Have some experience with computers to teach writing
<10	70	27 (39%)	38 (54%)
10–20	43	9 (21%)	23 (53%)
>20	111	19 (17%)	49 (44%)

On a scale of 1 to 5 in which 5 meant "strongly agree" and 1 meant "strongly disagree," only 31 teachers in the sample (14%) chose 4 or 5 when responding to the statement "I can identify appropriate computer programs to facilitate each phase of the writing process." With regard to some of the newer technologies, 21 surveyed teachers (9%) responded with 4 or 5 to the statement "I am an experienced user of computer multimedia." Even so, 47 teachers (21%) responded with a 4 or 5 to the statement "I know how to infuse technology effectively in my own teaching of writing."

Teachers' Perceptions About Computers' Usefulness in Writing Instruction

Two hundred and fifteen teachers (96%) agreed that computers could help students with writing. One hundred and fourteen teachers (51%) responded with 4 or 5 on the 5-point scale to the statement "A multimedia-enhanced learning environment may help students learn to write better." It is difficult to say on what they based their belief, given that half of the respondents did not consider themselves very knowledgeable about computers.

To get a sense of the effect of hands-on experience on these kinds of perceptions, responses of the nine survey respondents who had attended the 1994 workshop were compared informally with responses from the entire sample. All nine of them agreed that computers could help students with writing, and seven agreed that multimedia-enhanced learning environments might help students learn to write better. This suggests that teachers with direct experience of the new technologies for teaching writing may be more confident about using the technologies than those with no prior experience.

School Equipment and Facilities

As shown in Table 2, most of the schools surveyed are equipped with either IBM PC computers or Macintoshes. Twenty-one teachers (9%) reported that they had only Apple II computers in their schools. In addition, 128 teachers (57%) claimed that their school computers had multimedia capabilities, 98 teachers (44%) claimed telecommunications capabilities, and 100 teachers (47%) claimed networking capabilities.

Table 2. Computer facilities in the schools

	Number of schools	Percentage
PCs and compatibles	121	54%
Macintoshes	142	63%
Apple IIs	74	33%
Multimedia capabilities	128	57%
Telecommunications	98	44%
Networking capabilities	100	47%

Although most schools surveyed are equipped with computers to support writing instruction, the impression given by survey responses is one of inadequate infrastructure to support the most current available technologies.

Administrative Support

Most survey respondents did not believe they had received enough support from administrators to teach writing with computer technology. In part, this lack of support may be inferred from the inadequate level of equipment they reported. And although 163 surveyed teachers (73%) reported that their schools have the equipment to support computer-enhanced writing instruction, 85 surveyed teachers (38%) claimed that they were not strongly encouraged by administrators to use available equipment to teach writing.

How Much Time for Computer-Enhanced Writing Activities

Seventy-six teachers (41%) reported that they spent over two hours weekly in writing activities. However, 61 teachers (27%) reported that they spent less than one hour per week in writing activities. 131 (58%) of the teachers believed their students should spend more time on writing. If their class had greater access to computers for writing activities, 170 (76%) teachers believed that they would need more time for the activities, and only two teachers thought that writing time with computers should be decreased. Most teachers commented that writing instruction required plenty of revision practice and computers could make students' papers easier to read and correct. One teacher commented that writing was not the major issue. It was correcting papers that was the most time-consuming part of writing instruction.

Table 3. Time spent in current writing activities

Writing time (per week)	*N* = 185 Number of teachers	Percentage
Less than 30 minutes	18	10%
31–60 minutes	43	23%
1 to 1.5 hours	30	16%
1.5 to 2 hours	18	10%
2 to 3 hours	44	24%
over 3 hours	32	17%

Most-Needed Items in Writing Instruction

Teachers examined a list of 12 items related to the writing process and writing instruction such as correct usage, knowledge of paragraph structure, and feedback from peers. They then identified the three items from the list that they thought their classes needed most. The three items most frequently identified by respondents were, in order, feedback from teacher; correct usage; and examples/prose models. Then, they indicated which three items from the list where they felt *computers* could be most appropriately used to enhance the item's function in the writing process. The areas where computers were perceived to be most useful were, in order, correct usage, external stimuli (such as graphics, recording, videos, or multimedia), and drill and practice in sentence structure and vocabulary. The responses reinforce the impression that teachers lack familiarity with the latest technology. The uses for computers they could most readily imagine were reminiscent of early CAI software for writing. On the other hand, the responses also highlight a sort of blind faith that teachers have regarding the power of computers. Even though their view of computers seemed limited to grammar drill and practice, they consistently claimed that computers could be very useful in writing instruction.

Familiarity With Specific Programs

As a further check on teachers' perceptions, the survey included a list of 20 readily available commercial programs or kinds of tools. Listed items included *Holt Writer's Workshop, Inspiration, The Writer's Solution,* online dictionary, and database management. Respondents could indicate whether they had never heard of the item, had heard of it but had not actually seen it, or were actually using it in class. Overwhelmingly, respondents indicated that they had never heard of the items in the list. This further reinforced the sense that teachers need more information about available software.

Most Crucial Obstacles

According to survey respondents, the three top obstacles hindering teachers from using computers for writing instruction were: 1) insufficient time to implement computer-enhanced writing activities; 2) inadequate hardware for teaching; and 3) lack of needed technical knowledge and skill.

Features of Ideal Computer Programs for Writing Instruction

Respondents ranked the various features of computer programs according to their importance in writing instruction. Their overall ranking, from most important to least important, was as follows:

1. interactivity between computers and users
2. variety of examples (e.g., model paragraphs, sample student writing)
3. power (e.g., color graphics, speech capability, large database, etc.)
4. ease of use, without having to consult complex manuals
5. features (e.g., drafting or editing tools, dictionary, grammar checker, etc.)
6. correct information related to the writing process
7. teacher control of the program, or customizability
8. plenty of writing exercises

General Comments From Teachers

The teachers who use computers for writing instruction want greater access to computers. This was overwhelmingly clear from the open-ended responses to an item at the end of the survey questionnaire asking them to describe the ideal use of computers. Respondents frequently called for computers in every classroom so that they would not need to compete for lab time with other classes, or called for all students to have computers so that an adequate proportion of their writing time could be spent with access to technological tools. These comments echoed those made by summer workshop participants, though several of the workshop teachers had come from schools with exceptionally up-to-date computing facilities.

Of the teachers who had some knowledge and experience with computers, such as the minority who indicated in the surveys that they were familiar with a variety of software, or the teachers who had spent several days in a workshop experimenting with *The Writer's Solution* and other programs, a common request was for flexibility as well as power in software to support writing instruction. They wanted students to have a range of choices in their interaction with instructional software, and they wanted to be able to customize features such as multimedia modules for use with their particular curricula. For example, the ability to incorporate audio or video related to unit themes, genres, or periods studied in the English class was seen as a plus. Program features designed to help students generate ideas were considered most useful when they allowed students to pursue a single line of thought as well as when they stimulated divergent thinking.

Teachers who indicated that their knowledge of computers was limited called for easier ways to learn about useful computer programs. One called for on-site instruction in which teachers could try technological enhancements at their schools. Others simply called for more opportunities to learn about the latest technology. One teacher, voicing an opinion frequently heard in under-equipped schools, wrote "Don't get us excited" about the possibilities of computer-enhanced writing instruction without also considering the need to follow-through with up-to-date hardware and software resources.

Further Directions

With the fast growth of emerging technologies, many new ways to enhance writing instruction have become possible. Although most writing teachers have faith in computers to improve their students' writing performance, few have actually exploited the full potential of the computers in their own teaching. The results of this regional survey suggest that teachers are ready to move forward in their use of computer enhancements for the writing process, but that they need information and other support to do so.

Because technology and the interest in such issues as the Internet among the general public is expanding so rapidly, it is likely that conditions in schools have already begun to change since the survey was administered. To keep track of the expansion of computer applications in writing instruction, further research on teachers' implementation of technology in writing instruction will be needed.

Realizing Potential

The summer workshops pointed the way to a solution to this situation. Teachers in the workshop quickly adapted to the multimedia writing environment and showed how it might be possible to move forward from word processing to the next level of computer support for writing instruction, particularly in the areas of multimedia and the Internet. Teachers took great interest in the resources they could find on the net even though at the time of the workshops they could only access the World Wide Web using a textual interface. Many were quick to create expressive pieces using a multimedia publishing program, and all found some way to start, refine, or polish their writing using multimedia features of a comprehensive software package. Teachers especially saw the potential of electronic mail to help students make connections through writing, although technical difficulties during both workshops prevented teachers from exploring the potential of e-mail as much as they might have liked. Some guidelines from the workshop experience for helping teachers make the transition to the newest technologies include the following:

- Provide teachers with hands-on opportunities to experiment with software *for their own writing*. There is not likely to be a better way for teachers quickly to learn the drawbacks and the advantages of a particular program than by actual use. A hands-on, pre-evaluation approach such as the one used in the summer workshops has the additional advantage of helping teachers visualize how their students might make the best use of computers, and also eliminates many inhibitions that could keep teachers from comfortably using the latest technologies available to them.
- Take stock of existing hardware and software and determine whether it is being exploited to its full potential. For example, in schools where graphical interfaces are used for word processing, do students ever have an opportunity to compose in multiple windows simultaneously, or to share information with peers across their local network? If the hardware is primitive, perhaps networking can be simulated through exchanges of floppy disks, or through having students share computers for a writing session.
- Trust in teachers' ability to learn to use advanced software features. In the summer workshops, some participants had had only minimal experience using text-based word processing, yet by the end of one week they were creating multimedia materials and discussing how their students could use video, audio, and automated text analysis tools in their writing.
- Keep in mind that teachers are diverse not only in their experience with computers but in their perceptions of how valuable computers can be in writing instruction. To account for experience variations, consider some form of mentoring in which teachers who are more

comfortable using computers work in tandem with teachers who are hesitant to use computers instructionally. Acknowledge that one teacher might want to use computer features beyond word processing mainly to foster correct usage, whereas another teacher might be more interested in providing immediate feedback from a variety of sources.

- With adequate support, teachers can bridge the gap between the many exciting possibilities of technology in writing instruction and their current level of understanding and experience. The survey reported here, as well as the experience of 39 teachers in two summer workshops, is a positive sign that teachers are ready and eager to do more with computers in the writing class.

Conclusion

At present, computer technologies are becoming widely available in the schools. According to Begole and Penepinto (1995), last spring, an estimated 5.8 million computers were installed in the K–12 schools, for a national student-to-computer ratio of 9 to 1—a ratio that is almost 15 times better than it was a decade ago.

Today, in writing instruction, more teachers are using computers regardless of their years of teaching experience. They have shown confidence in the use of computers to improve students' writing performance. However, this survey study shows that teachers in this region are neither properly equipped with the needed knowledge and skill nor provided with appropriate access to the computer equipment to integrate modern computer technologies effectively in their writing instruction. Most writing teachers are not well-informed of recent computer technologies such as multimedia, networking, or telecommunications, and they do not know how to effectively enrich writing instruction with use of computers. But with proper support, these obstacles can be overcome, and the full potential of computers can be realized.

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General Session: Technology Implementation/Educational Reform

Breaking Down Classroom Walls

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Key Words: **instructional technology, telecommunications, networking, Electric Soup, remote network access**

Abstract

Hunterdon Central Regional High School is a suburban, public, high school of 1900 students on a 73 acre campus. Based upon the fundamental premise that the body of knowledge is expanding faster than teachers can assimilate or distribute that knowledge, the district has changed the instructional delivery system. The teacher is no longer the "sage on the stage" but rather a "guide on the side."

Instructional technology and telecommunications are seen as the means to bring the needed resources to the classroom. The district has made large investments in personnel, equipment and training to bring about the needed changes.

The district has installed telecommunications and data systems that include:

1. Fiber optic, level four, level five, data cable, and coaxial television cable to each classroom.
2. Telephones, voice messaging, student and staff voice mailboxes available from each room.
3. Two enterprise wide network systems are available to all 106 rooms. One is a high speed system for on campus connection to a 49 drive CD-ROM tower in the Media Center. One is a lower speed text based system for use over the telephone lines. Both are designed to permit dial in access from home. Both permit dial out connections to online databases.
4. The only new construction on this circa 1948 campus is a communications building with an operating radio and television station opened in 1992. Interactive television facilities are available in each room. Two satellite downlinks are operational with an uplink in the planning stages.
5. Three "classrooms of the future" were designed totally by teachers. Two of these rooms have received recognition for their design features.
6. A multimedia development project is staffed with personnel to assist teachers in the development of multimedia programs for use in their classes.
7. Release time for training, in the infusion of technology into the curriculum, was planned and carried out. An Academy for Continual Development was founded and has yielded unique curriculum materials developed across departmental lines.
8. Each of the over 800 computer stations is tied to the Internet via a full t-1 line. Bimonthly, students publish an award winning, online, Internet magazine called **Electric Soup**.
9. Each classroom has at least five computers tied to an **ATM** backbone network of over 800 nodes. Eleven local LAN segments, including bridged Ethernet and token ring segments routed at FDDI speeds, connect to a campus wide WAN.
10. A mixture of Apple, DOS, UNIX and Power PC's operating on one 850 node network.
11. Satellite data services are downlinked onto the school data network.
12. An online classroom attendance system that bridges an NCR mainframe system to the classroom network permits period by period posting of attendance.
13. A multiline modem pool available from each classroom.

Remote network access is available from students homes by dialing into any one of 36 different ports. Students have access to their work and our research facilities 365 days a year. The district has brought about a systemic change in how students receive their education. The district has a vision of the future that has led to seven regional and three national awards for technology (featured on Jim Lehrer news hour) in the last year. We have a vision for the future of education. We would like to share that vision.

Workshop

The Digital Chisel Workshop

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Key Words: **multimedia, Digital Chisel, interactive media, presentation software**

Its hard to believe that one of the few differences between the classrooms of today and those of the early Common school is the addition of an overhead projector (Mylet, 1994).

Sophisticated technology has become so pervasive in our lives that we seldom even notice its existence. From the automated bank teller to computers in our cars, technology is everywhere—everywhere that is, except the classroom. Technology can be a marvelous teaching tool but only if practical, understandable information about the integration of technology is shared with teachers.

This workshop is designed for the educator who has little or no knowledge about computer hardware, software or learning activities that involve technology. The goals of this workshop are many and varied, but each centers around The Digital Chisel as a classroom tool. Although the software presented will be The Digital Chisel, many other software packages will be discussed and compared. The goals are to illustrate how presentation software (regardless of the package) can assist teachers with:

- Student-created presentations that don't take weeks to complete,
- Animating classroom announcements,
- Adding video to any presentation with less than 3 clicks of the mouse, and
- Simple, technology-based additions to any curriculum area.

While it might be easy to talk about the new era of technology its another matter to deal with the uncertainty created by sophisticated equipment suddenly delivered to your classroom. Teachers are accustomed to being in control of their environment and the content they teach. Therefore, it is not uncommon to find excellent teachers who are apprehensive and reluctant to integrate technology especially when many classrooms are full of students who know more about technology than the teacher!

In order to combat "techno-phobia," The Digital Chisel Workshop will open with a basic explanation of the software, followed by numerous examples of classroom projects. Three cross-curricular activities will be created during the workshop and many handouts, and help worksheets will be available to assist even the most reluctant user. Blank computer disks will also be available, so projects created in the workshop can be saved for use in the classroom.

Traditional Poster Session

Public Schools Windows Online to the World Then 'N' Today: Intergenerational Living History (1900–1997) Pilot Project

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Key Words: **Internet, e-mail, security, telecollaborative, research, telecommunications, intergenerational**

Online, intergenerational Living History has proved to be an exciting interview project that provided a practical, realistic, doable entry-level Internet experience for K–6 students.

Senior citizen keypals' personalizing of history, through their remembrances of their experiences during the twentieth century, has made historical facts come alive for students.

Meadowbrook School fourth grade students and a group of senior citizen HOSTS (Help One Student To Succeed) Mentors, working in the SCAN (Senior Citizen Activity Center) computer lab at Monmouth Mall, have formed a pilot learning partnership to bridge the generations. Communicating, online, they shared questions and answers about life during the twentieth century when these senior citizen keypals were growing up.

Cooperative learning groups of students composed e-mail messages on their classroom computers using ClarisWorks. Then they saved their messages on a disk so that their questions could be copied and pasted into the e-mail form on a computer which was online.

The format of this project provided flexibility to overcome the coordination problems of accessing and using the Internet with K–6 students during school hours

Internet Security concerns were easily handled, since incoming e-mail to students was screened by teachers for appropriateness of message content, before students read and printed it to share with their classmates.

Meeting in their cooperative learning groups, to compose well thought-out questions for their senior citizen keypals, students discovered that they needed to do some "real research," through a variety of sources (books, CD-ROMs, Internet, etc.). Consequently, "writing for real reasons," students were provided with opportunities to improve their communication skills, while they explored the Internet through this guided curriculum-related project.

Senior citizen keypals, students, parents, teachers, and administrators have all enthusiastically endorsed this project. They found it to be a meaningful and stimulating method of learning history, developing telecommunication skills, and improving cooperative learning skills.

In June, these Living History accounts were published as a looseleaf notebook of e-mail and a game—"WOW/T 'N' T (Windows Online to the World/Then and Today): An Online Twentieth Century (1900–1997) Historical Happenings Dialogue Between Eatontown Meadowbrook School Fourth Graders and Monmouth County SCAN Senior Citizens."

To share the historical information compiled during this project, the game cards were also used as questions for an intergenerational "Tic-Tac-Toe/What Do You Know About Life in the 20th Century?" game. These shows were planned by senior citizens to air on cable TV and the big screen in Monmouth Mall.

A mini-pilot intercultural/intergenerational keypals project with Native American Pueblo students and public school students in New Mexico extended the scope of this project during its second year. Opportunities for students to develop skills needed to experience success in school and meet the NJ Core Curriculum Content Standards were developed through this telecollaborative project.

Paper Session

Designing Spectacle Island: A Case Study of Multimedia and Networking in Community Action

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Key Words: **multimedia, curriculum, community-based projects, middle school**

1. Introduction

CD-ROM technology and the World Wide Web can bring students to worlds that they could not otherwise explore such as the underwater archaeology or micro-biology. The same technology can be used to send students back into their own communities. The CD-ROM and Web can serve as home-base providing structure and the scaffolding upon which to invite students to use their own communities as resources and learning opportunities. This paper focuses on a community-based project in which CD-ROM and networked technologies brought students and their communities together in a common learning endeavor.

1.1 Background

During the fall and winter of 1995–1996, Boston's Public Television station (WGBH) and the Corporation for Public Broadcasting sponsored a collaboration among more than 20 education and media organizations in the city. The goal of this consortium was to create a set of activities and special events, all focused on a local 10-billion-dollar construction project, which would foster communication and learning across many sectors of the community. The construction project is known locally as "The Big Dig," and the consortium assumed the name of the "Big Dig Initiative." Each of the participating organizations contributed in some way towards this goal, through TV broadcasts, museum exhibits, special newspaper accounts, special events, Web sites and other multimedia products. The Full Spectrum Group at BBN created a CD-ROM based inter-disciplinary design challenge with an associated Web site, targeted for Middle School users.

1.2 The Big Dig

The Big Dig construction project has two major components, each involving the creation of a 1.5 mile long tunnel. One tunnel is being constructed to replace an aging elevated highway structure that carries a portion of I-93 through the heart of Boston. A second tunnel is being constructed to extend I-90, which runs between Seattle and Boston, eastward beneath the waters of Boston Harbor to a terminus at Boston's Logan International Airport. These two tunnels create more than 13 million cubic yards of excavate, hence the project's nickname "The Big Dig."

The activities and events created by the Big Dig Initiative group involved many different elements of the construction work. The Middle School project focused on one relatively minor but timely piece of the project as it posed design issues as yet unsolved by the construction company. This piece involved using 3.5 million cubic yards of the tunnel excavate to 'cap' an old landfill on one of the islands in Boston Harbor and then creating a public recreation area on the island.

2. The Spectacle Island Curriculum Challenge

2.1 General Comments About the Curriculum Design

One characteristic of a CD-ROM based multimedia curriculum unit is its capacity to allow students to explore and interact with worlds otherwise inaccessible to them. For example, a recent product created by the BBN Full Spectrum group allows students to construct an understanding of the population dynamics and survival issues of an Orca whale population living around the San Juan Islands of British Columbia and the state of Washington. Video taped interviews of Orca researchers were included on the CD-ROM to serve as a resource for students. The Spectacle Island CD-ROM was designed very differently. It is a community-based project, designed to lead users off of the CD-ROM and into direct contact with members of their own larger community to build their resources and their own understandings of the issues.

Another characteristic of the Spectacle Island curriculum unit is that it was based on a real design project. While students gathered information and developed design proposals for the new island-park, local architects and planners were involved in the very same process, creating design proposals for the owners of the island. Towards the end of the school project period, students from participating classrooms attended a meeting with the professional design team, where all groups had an opportunity to share their ideas with one another.

A third feature of the unit is its modular construction of eight separate but inter-related design components. This feature encouraged the formation of multiple design teams within a classroom to work on different elements of the park. Collaboration both within and among design teams was essential to the development of a coherent design. This collaboration is parallel to the process common to many large real-world projects, where for example, architects, engineers, contractors, and government officials must collaborate in order to complete the design for a project. Another benefit of the modular construction was that it allowed classrooms and teachers to develop final designs and products for selected portions of the park as fit their interests or time constraints. Classes were able to complete just two or three components of the design and still have the experience of participating in a complex and interesting collaborative project.

2.2 The Curriculum Unit

The curriculum unit was composed of two main strands. *Park Design* addressed general land-use considerations, recreational opportunities, and public access to the island. *Visitors' Center Exhibit Design* focused on the development of a set of informative exhibits for the park's visitor center. Each of these strands had four elements. An outline of the unit is provided below. There were two primary reasons for the project's large scope. One was to increase the likelihood that participating teachers would find specific elements which were related to work that was in progress in their classrooms, and the other was to accommodate the wide range of student interests typically found in a classroom. It seemed unlikely that any one classroom would try to work on all elements during the time frame of the Big Dig Initiative, which was less than three months.

I. Park Design

- *Public Access Plan*
  Design a ferry transportation system that will provide public access to Spectacle Island.

- *Recreation Area Design*
  Select and locate on a plan of the island a variety of recreation options for visitors of all ages.
- *Natural Area Design*
  Select and locate on a plan of the island a variety of plants which will flourish in the harbor environment and which will attract and support the animal life on the island.
- *Park Operations Manual*
  Develop plans and policies that deal with the management of the park, with a specific focus on public safety, public health, and visitor support facilities.

II. Visitors' Center Exhibit Design

- *Earth Move Exhibit*
  Design exhibits that will help visitors to visualize both the 3.6 million cubic yards of earth deposited on Spectacle and the resulting transformation of the island's topography.
- *Social History Exhibit*
  Design exhibits that will allow visitors to become more familiar with Spectacle Island's unique history.
- *Natural Environment Information*
  Develop materials for self-guided nature trails and other exhibits which will introduce visitors to the plant and animal life on the island
- *Visitors' Center Design Guide*
  Create a set of guidelines for the developers of the Visitors' Center exhibits which address issues such as target audiences for the exhibits, reading levels, and degrees of interactivity.

2.3 Comments About Selected Resources

The curriculum unit was much larger than any classroom might typically take on in one block of time. The primary reason for creating a project of such a scope was to allow participating teachers and students to select a unit which might extend work that was in progress in their classrooms. Furthermore, the set of eight elements increased the opportunities for collaborations both within and outside of the classroom.

Since the new topography of the island resulting from the deposition of tunnel excavate was quite dramatic, students had to do a very careful review of the contour map before they could make informed decisions about how to use the land. One resource provided with the curriculum were instructions for constructing a simple slope measurement tool, so that students could investigate slopes in their own community to better understand the relationship between slope and land use. (How much slope, for example, would be safe for a skateboarding area?)

Students were asked to estimate a target population for the island and to then establish a ferry schedule that would provide convenient public access. As one resource, students were provided with ferry information on the CD-ROM. This information was assembled by an expert in the field of water transportation, and students were also advised to contact local tour boat operators to get additional perspectives about water transportation.

To help them develop a *Park Operations Manual*, students were given two suggestions: visit neighborhood parks or recall facilities they had seen on vacations, and visit service providers in their own neighborhoods, firefighters, for example, to learn more about what might be needed to provide fire protection for an island park.

Work on the *Social History Exhibit* was supported in two ways. A Web site, created by a local museum participating in the project, provided information about Native American use of Spectacle Island across a 4,000-year period of history. The CD-ROM, contained a set of excerpts from an interview with a woman who lived with her family on Spectacle Island until the age of 19. Her father was manager of the city dump housed on the island at that time. Now in her eighties, she provided entertaining stories, wonderful memories, and a large collection of family photographs to support the project. The CD-ROM provided a photo-journal of Billie's life and asked students to make a parallel journal from their own families' histories. Students were encouraged to interview their parents, grandparents, neighbor about their lives and complete a partially filled in timeline, with both world events and information obtained from the interviews. They were asked to make connections between what was happening to Billie and people within their own communities at the same time periods. Considering the information provided with the curriculum and their own research, students were invited to write historical fiction about the island.

A second exhibit focused on the natural history of the island To help them prepare an exhibit that reflected the topographical transformation of the island students were provided with specially developed electronic tools on the CD-ROM including area and slope calculators.

3. Field-Testing With School Partners

3.1 The Classrooms

Eight Boston area classrooms field tested the curriculum. Seven were in middle schools and one served a population of adult learners from the Haitian community. Of the seven middle school classrooms, one was a self-contained environment that served learning-challenged students. Together the set of classrooms reflected the cultural and economic diversity typical of a large metropolitan area. The technology resources of the classrooms were equally diverse, ranging from a classroom that borrowed time on a computer in another classroom to a classroom that had regular access to a large computer lab with full Internet connectivity.

3.2 Teacher Feedback and Support

We met formally with the participating classroom teachers three times during the development of the curriculum and CD-ROM to solicit their feedback and ideas. In addition, an e-mail listserv was maintained and moderated by a BBN project member. This listserv was used to post regular updates about the Big Dig, new resources discovered by the classrooms, and reports on classroom activities. Videotapes produced at WGBH which documented three previous years of Big Dig construction progress were distributed to participating classroom teachers to provide them with background information as they prepared to use the curriculum.

During the feedback meetings some of the teachers expressed a strong desire to make full use of the "reality" aspect of the this project. This seemed particularly important to a teacher whose students' learning was focused on gaining skills and understanding applicable to the job market. With this in mind, WGBH agreed to host a meeting where student representatives from each design team could present their work to the professional designers who were developing plans for Spectacle Island Park. In addition, it was agreed to take all of the participating classrooms on a cruise in Boston Harbor where they could observe the earth moving operation in progress on Spectacle Island and get first hand view of the contour of the island.

3.3 Student Projects

Late in the winter of 1995 the student projects were formally shared with other participating classrooms, the professional design team for Spectacle Island Park, and members of the Big Dig Initiative advisory board. Seven of the eight participating classrooms were present for the event. Having the opportunity to present their work to the designers was of course a powerful experience for the students.

Two classrooms presented HyperStudio projects on the history of the island, as well as design ideas for the park. One of these classrooms was the self-contained classroom of learning challenged students. Their work was well appreciated by the other students and adults at the meeting. In this situation, technology became the common ground on which students from very different environments could meet and appreciate each others' work.

Students from the adult learning center used the Spectacle Island contour map to investigate the mathematics of slope, a concept they needed to understand as they participated in the E.D.P.

High School equivalency course. These adult students also proposed establishing a section of the island for growing medicinal herbs, something that reflected a part of their Haitian culture. They viewed an herb garden as an attraction that would draw park visitors back to the island for return trips. The idea of an herb garden became an interesting topic of discussion since medicinal plants transported by some of the earliest European settlers had been planted on Spectacle Island. These adult students later created a 3-D scale model contour map of the island and, with support and encouragement from their instructor, created a Web site that reported the historical use of Spectacle Island as a site for growing medicinal herbs.

Students from the middle school with the greatest access to technology produced an elegant Web site to hold their park design. Their site also included stories and a song the class had written to commemorate the history of the island. The science and English teachers collaborated, using the Spectacle Island project as a vehicle to introduce many features of Internet use. This encompassed HTML programming, image scanning technology for Web page graphics, the retrieval of specific information from the Web and e-mail communication with government officials and experts.

Two schools with very limited computer access simply viewed the CD-ROM and the Web site as a way to initiate their work. They then proceeded to create their park designs and display them on poster-sized maps of the island.

One class with a large population of non-native English speakers created a photo-essay journal exploring this medium as a means of communication.

The depth and direction the students and teachers took reflected the particular opportunities available at each school as well as the needs and focus of the classroom at the time. This range of responses was supported by the modular design of the curriculum project, which invited classrooms to participate in anywhere from one to eight investigations, and to feel a sense of accomplishment in completing each piece.

4. Formative Evaluation

The evaluation was formative and informal. Its purpose was to help us explore some of the activities and goals the project was intended to support:

- Did the design of the project (curriculum units, CD-ROM and Internet) support using the local community as a resource?
- How important was it that the design challenge was authentic and that solutions were to be presented to a real audience?
- What types of collaboration were fostered?
- What contribution did the technology bring?

Our data come from five sources: classroom observations, teacher interviews, e-mail from teachers, the student presentations made at the design presentation, and videotaped interviews with students and teachers in three of the classrooms.

4.1 Did the Design of the Project Support Using the Local Community as a Resource?

Although the Big Dig is a community event and regular news items appear in the media almost daily, many students had paid little attention to these news items prior to their use of the curriculum. As noted above, the curriculum encouraged students and teachers to reach out into their communities. This they did. They spoke with and invited community members into their classrooms, and contacted local authorities using both e-mail and telephone. Students spoke with local ferry operators, botanical specialists, a bicycle path designer, writers, and architects. Inviting specialists into the classroom was a very motivating experience. Students prepared and focused their work in order to be able to ask "intelligent" questions of their adult colleagues. The Internet was used to reach experts in the larger community. Students e-mailed park rangers across the country to ask questions about park design.

4.2 How Important Was It That the Design Challenge Was Authentic and That Solutions Were to be Presented to a Real Audience?

In all classrooms the challenge of creating a design for an authentic and as yet unsolved problem (how to create a park on the newly contoured island) proved to be highly motivating. Equally motivating was the fact that the student designs were to be presented to the professional designers. Students took seriously the notion that "adults" would pay real attention to their work. For those who created Web sites the question of audience had an additional component. Knowing that their work could be viewed world-wide added an additional level of attention to quality and presentation.

4.3 What Contribution Did the Technology Bring?

4.3a The CD-ROM

The Spectacle Island CD-ROM provided both materials and structure. The materials included many which would have been difficult for students to secure on their own, such as interviews, video images of the island over time, and interactive models. These materials provided a structure upon which students could base their community research. Some classrooms focused on the mathematical activities and tools embedded in the design challenges, such as an electronic tool for portraying slope. Other classrooms were more interested in the social history and the interview with a former Spectacle Island resident. Additionally, the CD-ROM supplied strategic resources that deepened and extended understanding. A case in point is the contour map of the island, which provided support for the authentic task of understanding the constraints and possibilities afforded by the topography of the island. This simple but highly strategic resource generated challenging work for many learners. In one case, it lead a group to construct a 3-dimensional scale model of the island. This was a group of adult learners who appreciated the connection between map-reading skills and their daily lives.

4.3b The Internet

For the students and teachers in one middle school, the ability to reach a world audience was particularly motivating. The teachers, with the help of high school mentors, learned HTML and passed on this knowledge to their middle school students. Both students and teachers were involved in learning the medium and exploring its potential power. Much attention was paid to presentation and the connections between curriculum pieces in addition to content.

For the adult learners, the community building potential of the Internet was particularly salient. Access to the Internet became a means of joining forces with other similar adult education programs.

The Internet was also a source of information, albeit at times a difficult one. Although students who had access were given significant time to search the Internet, they were not yet well versed in search techniques and the process was time consuming. The teachers felt this was time well spent as it helped students to refine their search, techniques. Following a successful search, students communicated via e-mail with experts. This was a new means of communication and information gathering for them.

4.3c Student Work—Multimedia Presentations

Most of the students' projects were presented in a multimedia format, using either HyperStudio stacks or Web sites. The integration of content and visual presentation became a challenge to both the students who produce the presentation and the teachers and students who evaluated the work. The assessment of multimedia products was a focus for one of the teachers. Her students helped develop rubrics for the content and presentation of the work. We found in each of the cases where student work was shown (design meeting, mini-conference at the Massachusetts State House and a conference sponsored by WGBH),that the appeal of the medium influenced viewers' interest and perception of the value of the content.

4.4 What Sort of Collaboration Was Fostered?

Collaboration was a central intent of both the Big Dig Initiative in general and the Spectacle Island Curriculum in particular.

Teacher collaboration was fostered by the interdisciplinary nature of the challenges. Most classrooms in our study followed their established collaboration patterns. In a few cases the collaboration practices shifted. Two teachers who previously did not have Internet connection purchased machines and hooked up from home. In this way they were able to receive e-mail directed at the group and engaged in reaching larger communities through joining lists and exploring the Web. In one school, collaboration between writing, science, and math was enhanced. While these collaborations existed before, the fact that the product of their joint effort would be presented to a wider audience made this collaboration more compelling. Teachers realized that they needed their work to fit together well to ensure the overall quality of the product.

In all of the classrooms, students worked in small cooperative research groups. In most cases they focused on separate aspects of the design challenge before coordinating their final presentation. Some classrooms presented one or two designs which consolidated the work of the whole class, while in others 5 or 6 design profiles were presented.

Collaboration with other members of the Big Dig project was focused largely from the meeting at WGBH. Adult learners from the Haitian center established contact with the Boston Museum of Science to plan further development of their herb garden proposal. One school with limited Internet access was offered help by an advisory board member. The contractors for the Big Dig construction orchestrated a boat trip by the island, in response to student and teachers request to see the island.

Conclusion

A community based project supported by judicious use of technology can help students connect with their local communities and exploit the rich resources they have available to them. Integral to the success of such a project is the authenticness of the task. A task that embraces a real problem and whose solution has a real audience is highly motivating. The CD-ROM based curriculum developed at BBN as a component of the Big Dig initiative provided critical information, engaging material and a structure to support students' research in their own communities.

Workshop

An Introduction to VRML: A Tool for Building 3-D Worlds

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Key Words: **VRML, 3-D, browsers, programming**

Introduction

VRML is a language for describing three-dimensional worlds that can be viewed on the computer. VRML 2.0 is a public standard that is followed to varying degrees by competing companies and institutions in order to facilitate the sharing of 3-D information across the Internet and across different computer systems. These virtual 3-D worlds allow the viewed to move around within them by using specialized 'browsers' which present an animated sequence of 3-D renderings resulting in a truer 3-D effect than we are accustomed to.

Virtual worlds are described using ASCII files that contain VRML commands including references to other VRML files, links to other types of files (HTML, etc.), and references to images. These files may be built from scratch (kind of like writing a postscript file) or with a VRML builder (a tool that does for 3-D what paint/draw programs do for 2-D) although the 'Dummies' book on VRML suggest that "... you'd have to be an Einstein to create anything interesting" when building a VRML world using only a word processor—we disagree. There is a significant potential for teaching and learning design, computer programming, geometry (coordinate systems, perspective, polyhedra, etc.), and trigonometry through the 'hands-on' construction of virtual 3-D worlds—although we would also recommend the use of a spreadsheet for generating vertex coordinates and face sets.

These pages are intended to provide a basic introduction to building and browsing VRML worlds for the high school classroom teacher. As VRML is an evolving standard with different VRML browsers, plug-ins, and worlds becoming available, these materials include only an overview of the types of topics we will discuss in our workshop. A more complete and current set of materials will be distributed as part of the workshop.

For more information, you many contact us at:

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or access our VRML Web site at:

http://castle.uvic.ca/educ/lfrancis/web/vrml.htm

Browsing VRML Worlds

Before you can view a VRML world, you need to find and download a browser. There are two basic types of browsers:

1. stand alone computer programs that may act as helpers to the standard Web browsers (Netscape, Internet Explorer, etc.), and
2. plug-ins that fit seamlessly within the Web browsers.

Many different browsers are available on the Internet and can be located easily by searching for VRML. Our choice at the moment is Live3D (available through Netscape), simply because it is the only reliable PowerMac-based VRML browser we have found. We prefer the plug-in, because it allows the flexibility to view a VRML world whenever you come across one while surfing the WWW, while providing a familiar interface when simply viewing a local file.

As with all new technologies, the VRML browsers, and helper applications available are generally marginally reliable, offer a limited subset of the full VRML standard, often promote or support non-standard features, and are updated frequently. Thus, the user may need to try out several different programs in order to find one that suits his/her needs and then check for updates as needed. We must also warn you that VRML is a resource hog. Larger and more complex 3-D worlds require leading edge equipment (Unix boxes, high speed Pentiums and PowerMacs) to effectively explore them, but smaller worlds can be explored with more modest equipment.

There are many sites that offer VRML worlds for you to explore. By simply searching for the keyword "VRML," you will find many different files and links to other VRML sites. We have tried to provide you with several starting sites on our VRML Resources Web site. **"The VRML Foundry"** and the **"VRML Repository"** are two good starter sites that have links from our Web site.

Navigating in 3-D

Moving around in a VRML world is accomplished by fairly natural mouse or keyboard actions. Each browser is a little different in it's approach, but the basic moves are generally all available.

As an example, the Live3D browser has the following types of movement:

Point: Click on a point in the scene and the browser animates the movement towards that point until the point is centered on the screen and the view position is closer.

Walk: By holding down the mouse button, and dragging the cursor up or down you can move into or out-of the scene. If you drag the mouse left or right, the direction you are facing changes.

Spin: When you are in this mode, the world spins in the direction you drag the mouse.

Slide: This mode allows you to shift the world up, down, left or right by dragging the mouse while leaving your direction of view fixed.

View: Whenever a VRML world is opened, it is set to an initial view (location and orientation). In addition, the designer may optionally specify alternate views of interest. When the user selects one of the listed views, the browser automatically moves to that predefined location and orientation.

In addition to these movements, you can adjust what you see, by turning on or off any one of these features:

Headlight: Provides a virtual light source from the position of the viewer. VRML worlds often appear dark and this tool provides a valuable adjustment.

Lighting: By default, Live3D uses a fancy type of shading to enhance the lighting effect, and smooth off the sharp edges. If you have a slower computer, you may find that switching to flat shading allows for more efficient movements.

Detail: If you need even more speed (to navigate a large VRML world), you might switch from solid faces to a wireframe mode where the browser only provides an outline of the faces that would be visible to you.

Collision Detection: This added feature allows the user to choose whether or not the objects are solid. When selected, a user will not be allowed to 'walk through walls' thereby enhancing the 'reality of the virtual reality'.

Building VRML Worlds

VRML is relatively straightforward, and can be mastered fairly quickly. Although the building of complex 3-D worlds can be somewhat tedious, modest VRML worlds can be built with the use of a simple word processor and spreadsheet. In the next couple of pages we present an abridged list of VRML code elements along with their syntax and an example VRML file that includes comments (everything after the #'s) to assist you in understanding some of the "code" that might be found in a typical VRML file. We have avoided some of the features available in VRML because either they were not implemented in our browser or they were overly cumbersome to use.

Important Notes

- All VRML files must have the extension "**.wrl.**"
- All names are **case sensitive**.
- Movements, transformations and drawings are done **relative** to the last position.

- The cursor position starts at the 3-D coordinate (0,0,0) looking down the z axis.
- The units of measurement are selected by the author of the VRML page.

VRML code:

There are four main components in a VRML file (Header, Comments, Nodes and Fields):

Header—required

The following statement must appear as the first line of any VRML file. For instance, if VRML 1.0 was used we would write:

```
#VRML V1.0 ascii
```

Comments—optional

Any text on a line following a "#" character is ignored (excepting the header above).

Nodes—required (assuming you want something to be drawn)

Each node has the following form:

```
Name { field1 field2 …}
```

Fields—optional information to define attributes of the Nodes.

If fields are not provided for a node, then defaults will be used.

Selected Syntax Examples

Cube { width 3.0 height 5.0 depth 4.5 }

#draws a cube centered on the current position

#default width, height, and depth are 2.0

Sphere { radius 1.5 }

#draws a sphere centered on the current position

#default radius is 1.0

Cylinder { height 4.0 radius 0.5 parts (SIDES|BOTTOM) }

#draws the walls and bottom of a cylinder

#default height is 2.0, radius is 1.0, parts ALL

# parts may be: ALL, TOP, BOTTOM, SIDES

Cone { height 2.3 bottomRadius 1.1 parts (SIDES) }

#draws the cone without a bottom

#default height is 2.0, bottomRadius 1.0, parts ALL

#parts may be: ALL, BOTTOM, SIDES

Material { diffuseColor 0 0 0.2 }

#changes the color to some combination of RGB

#many other fields are available

Coordinate3 { point [-3.2 0 2.2, 3.2 0 2.2, 3.2 0 -2.2, -3.2 0 -2.2, -3.2 2 0 , 3.2 2 0] }

#define the vertices to be used relative to origin

IndexedFaceSet { coordIndex
[0, 1, 5 4, -1, 1, 2, 5, -1, 2, 3, 4, 5, -1, 3, 0, 4, -1, 3, 2, 1, 0] }

#define the faces as sets ordered (ccw) sets of points

#-1 identifies that there is another face following

Translation { translation 2.0 1.25 -2.0 }

#moves the origin relative to the last origin

Rotation { rotation 0.0 1.0 0.0 3.14 }

#rotates about the y axis, any unit axis could be used

#rotates by pi radians, using right hand rule

Scale { scaleFactor 1.0 0.5 3.2 }

#scale each of the dimensions individually

Separator { nodes }

#groups nodes together

#isolates position, scale and rotation of nodes

#so that they are not changed outside of the group

Below is the code for a sample VRML world built using VRML V1.0. It creates a house, grass and trees.

```
#VRML V1.0 ascii
PerspectiveCamera { position 10 3.5 10 orientation 0 1 0 0.8 }
DEF BackgroundColor Info { string " 0.3 0.3 1.0 " }

# define a building with a red door and two windows
Separator {
 # building
 Material { diffuseColor 0 0.7 1 }
 Translation { translation 0 1.25 0 }
 Cube { width 6 height 2.5 depth 4 }

 # a note about home sweet home
 Separator {
 Material { diffuseColor 1 0 0 }
 Translation { translation 0 0.85 2.05 }
 FontStyle { size 0.4 }
 AsciiText { string "Home Sweet Home" justification CENTER}
 }
 # door
 Material { diffuseColor 1.0 0.2 0.2 }
 Translation { translation 0 -0.25 2.0 }
 Cube { width 1 height 2 depth 0.1 }
 # window
 Material { diffuseColor 1 1 1 }
 Translation { translation 2.0 .25 0 }
 Cube { height 1.5 width 1 depth 0.1 }
 # window
 Material { diffuseColor 1 1 1 }
 Translation { translation -4 0 0 }
 Cube { height 1.5 width 1 depth 0.1 }

 # roof
 Material { diffuseColor 0 0 0.2 }
 Translation { translation 2.0 1.25 -2.0 }
 Coordinate3 { point [ -3.2 0 2.2, 3.2 0 2.2, 3.2 0 -2.2, -3.2 0
  -2.2, -3.2 2 0 , 3.2 2 0 ] }
 IndexedFaceSet {
 coordIndex [ 0 , 1 , 5 , 4 , -1, 1, 2, 5, -1, 2, 3, 4, 5, -1, 3,
  0, 4, -1, 3, 2, 1, 0 ]
 }
 }
# the green grass
Separator {
 Material { diffuseColor 0 0.8 0.3 }
 Translation { translation 0 -0.1 0 }
 Cube { height 0.2 width 80 depth 80 }
}
 # the coniferous tree
Separator {
 Material { diffuseColor 0.2 0.8 0.6 }
 Translation { translation 8 2.4 2 }
 Cone { height 4}
 Material { diffuseColor 0.3 0.2 0.2 }
 Translation { translation 0 -2.2 0 }
 Cylinder { height 0.4 radius 0.2 }
}
# the deciduous tree in fall
Separator {
 Material { diffuseColor 0.9 0.7 0.5 }
 Translation { translation -5 1.5 4 }
 Sphere { }
 Material { diffuseColor 0.3 0.2 0.2 }
 Translation { translation 0 -0.5 0 }
 Cylinder { radius 0.1}
```

Traditional Poster Session

Applied Sociology in Virtual Worlds

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Key Words: **virtual reality, VRML, simulation, sociology, history**

Yesterday's science fiction is beginning to find a place in today's classrooms. Multi-user, real-time, interactivity in three-dimensional virtual worlds is now available on the Internet. Access to these worlds is becoming available to a broad range of educators and has the potential to radically change pedagogy. Drawing on lessons we taught high school students at the Isidore Newman School in New Orleans, our presentation will highlight emerging possibilities created by Internet-based, non-immersive Virtual Reality. In particular, we will focus on using Virtual Reality in the history curriculum to role-play important historical figures and events. Using the Internet and a VRML browser, SIGGRAPH 97 participants will be able to interact in real-time with Newman high school students in New Orleans who will be role-playing prominent characters from the U.S. History curriculum.

Technology can be used to transform a traditional textbook and lecture based history course into a class where students become directly responsible for constructing their own knowledge. The U.S. History curriculum and Newman school has been transformed by an ambitious school-wide technology plan designed to encourage greater student participation throughout the curriculum. During a unit on President Andrew Jackson, U.S. History classes conducted research on the Internet and created multimedia interactive presentations about Jackson. The students were challenged to think from the perspectives of text book authors, graphic designers, and multimedia developers to create dynamic educational material about this president of the United States.

Although this assignment encouraged students to understand a broad range of perspectives, they never addressed the material from the perspective of Andrew Jackson himself. Jackson remained the object of study. Using a shareware Virtual Reality Modeling (VRML) browser, we were able to create a virtual historical world where students could role-play Andrew Jackson and other important figures from his time. This allowed them to actually become their object of study. To do this, they picked out a 3-D virtual body, called an avatar, that became the visual representation of President Jackson. Then, they created a "public card" that contained information about Jackson that everyone in the virtual historical world can access. Once this was completed, Jackson was ready to venture out into social space and engage in lengthy real-time conversations with modern-day people from around the world.

These modern-day people could potentially include history students and teachers from schools across the country. During these role-playing projects, Newman students provide online historical interpreters that are available on the Internet several hours each day. Students in Nebraska, Japan, or France can discuss politics with a virtual Andrew Jackson being role-played by the knowledgeable American History students at the Isidore Newman School. We save the transcripts of these dialogues and use them to evaluate our students learning processes and fine tune the U.S. History curriculum.

VRML environments originated in the academic computer department's curriculum (See Peretti, J. "Applied Sociology in Virtual Worlds," *The Technology and Education Annual.* Forthcoming from Thomas and Bacon). Our presentation will trace the use of this technology as it moved from the computer department to other disciplines. We will pay particular attention to the history project outlined above. SIGGRAPH participants will be invited to interact in real time with a host of historical figures role-played by high school students in New Orleans. We will conclude our presentation with some suggestions on how this technology could be integrated into the curriculum across the disciplines.

Biology, for example, could be transformed by VRML worlds that help students visualize complex biological structures. Biology students will be able to navigate 3-D simulations of cells, organisms, or ecosystems. Computer-based alternatives to dissection have already become widespread. Unfortunately, these current simulations replace a 3-D organism with 2-D diagrams. VRML Worlds can solve this problem by modeling organisms in 3-D space. Students will be able to journey into a frog's stomach or travel through a cell's membrane to get a closer look at a mitochondria. Best of all, students will be able to explore that same frog or cell simultaneously. That means that they can "meet" at the frog's pancreas to discuss enzymes or at the cell's membrane to discuss osmosis. Indeed, Biology teachers will be able to give guided tours through biological entities that were previously represented by flat diagrams in textbooks. In this instance, computer simulation provides more than a humane alternative to dissection. VRML simulations have the potential to allow students to see the invisible, travel through microscopic worlds, and participate in unparalleled distance learning over the Internet.

Workshop

The Art and Science of Multimedia Design

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Key Words: **multimedia, collaborative learning, school community, authoring**

Stop consuming educational software and teach your students to work collaboratively to produce dynamic, multimedia software customized for your school community. This workshop is designed for teachers who use educational authoring software (i.e. HyperStudio, HyperCard, or MicroWorlds) and want to take their lessons to the next level. Demonstrations and hands-on exercises will focus on interactive, collaborative, and multimedia story telling. Teachers from all disciplines will learn to coordinate a unit where a class works collaboratively to produce a professional-looking software title.

Internet Poster Session

Water Science for Schools World Wide Web Site

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Key Words: **water science, water use, water conservation**

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The U.S. Geological Survey's Water Science for Schools World Wide Web Internet site is an educational resource about water for students and teachers throughout the country. The site deals with many aspects of water science and water use in the United States. Students can interactively investigate water as a national resource and water's many uses.

User Assistance

- Introduction/User Help
- Student Guide
- Teacher Guide
- Water terminology and glossary

Water Basics

- The water around us
  - The physical and chemical properties of water
  - Earth's water: Rain, Rivers, water, Lakes and reservoirs, Glaciers
  - The water in your body
- Earth water facts
  - Where is Earth's water located?
  - How much water is there on (and in) the Earth?
  - Follow a drip through the water cycle
- The traditional water cycle

Special Topics

- Acid rain
- Water desalinization
- Water conservation

Water Use in the United States

- Summary of water use in the United States in 1990
- Water use by category (each section has textual information, data tables, bar charts, pie charts, and maps)
  - Domestic
  - Public supply
  - Industrial
  - Irrigation
  - Power production
  - Sewage treatment
  - Livestock
- Storytime: How water plays a role in building a town
- Human influence on the water cycle
- The water-use cycle

The Interactive Center

- The Student Activity Center (student fills out forms, then data tables show how students in all states answered)
  - Student Questionnaires:

(1) Where does your home drinking water come from?
(2) What kind of drinking water do you use at home?
(3) How much water do you use at home on a Saturday?
- Student Opinion Surveys:
(1) What do you think the biggest water problem will be in the next century?
(2) How do you rank water concerns with other environmental issues?
- Student Challenge Questions:
(1) How much water does it take to grow a hamburger?
(2) How many baths can you get from a rainstorm?
(3) What are the properties of water?
(4) How much water does a dripping faucet waste?

The Picture, Chart, and Map Gallery

- The Picture Gallery
  - Many pictures about water use, how we measure water, water events (floods), and man's influence of the hydrologic system. Text accompanies each picture.
- The Chart and Map Gallery

Water Questions & Answers

Certificate of Completion

Internet Poster Session

Distance Learning: Providing Staff Development in Context

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Key Words: **distance learning, staff development, learning in context**

Research has long reported the importance of context in students' learning; however, this importance seems to be forgotten in most staff development programs. Staff development leaders often model the "Do as I say, not as I do" teaching strategy—telling theories and techniques to passive learners. It seems intuitive that teachers presented with new strategies, content, methods or theories may be more reluctant to internalize these learnings without a contextual base. That is, without seeing it in action, preferably with their own students, or without trying it first hand, teachers can easily discard the ideas, saying "Not my kids ..." or "I could do that if I only had ...."

TEAMS Distance Learning, created seven years ago at the Los Angeles County Office of Education, was originally funded as a Star Schools project from the U.S. Department of Education's Office of Educational Research and Improvement (OERI) and has subsequently received two additional grants from them. TEAMS provides direct instruction in mathematics, science, history/social science and language arts. In a unique partnership with PBS stations, cable companies and ITFS systems, TEAMS is downlinked and rebroadcast live on these systems, enabling TEAMS to grow to more than 140,000 students in grades K–7 in over 20 states. A significant feature of the TEAMS model is the simultaneous delivery of direct instruction to students and ongoing staff development for teachers. Studio instructors provide exciting, hands-on activities for students who interact via fax, phone, US mail, e-mail and the WWW. In a team teaching partnership, studio instructors act as mentors to classroom teachers, providing in-class staff development. These student programs are effective models of national standards in teaching strategies and content. The twice-weekly student programs provide a low-risk environment for teachers because classroom teachers team-teach with studio instructors who are master teachers. Teachers participate with their own students in constructivist-based active learning activities, encouraging collaborative and cooperative learning. Even more powerful than the academic gains made by TEAMS students is the teacher growth which takes place. TEAMS features curriculum in a rich context—students learn content and process, while teachers learn teaching strategies and techniques.

In the 1994–95 school year, TEAMS broadened its telecommunications access to include a Web site and began exploring and developing instructional Internet applications. The TEAMS Distance Learning home page provides not only extensive annotated links and resources indexed by subject, but also collaborative, interactive online projects. One of the unique features of the TEAMS home page is that all studio instructors have their own Electronic Classrooms©, providing teachers with a variety of ways to communicate and interaction with the instructors, as well as relevant staff development materials and resources. While the TEAMS home page was created for TEAMS teachers to enhance and support the televised instruction, it offers all K–12 teachers and students a powerful teaching and learning tool.

This poster session will include samples of TEAMS programming, teacher feedback on TEAMS Distance Learning as a staff development tool, information on implementing TEAMS Distance Learning, and photographs of TEAMS classroom implementations.

General Session: New Curriculum Designs/Instructional Strategies

Intranets to Create a District Multiple Intelligence/Multimedia/Integrated Instructional Environment

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Key Words: **Intranet, integrated curriculum, administration, electronic portfolio**

Summary

Utilizing our school district's network, our team plans to develop a computerized curriculum database and electronic portfolio database for our district that will be linked using hypertext (HTML) and accessible to all interested users utilizing Web browser software (for example, Netscape Navigator).

These two databases will better serve students, staff, and parents in our district by:

1. Offering improved accessibility to curriculum.
2. Improved monitoring of student outcome's.
3. Greater flexibility to meet individual learners' needs.

4. Better organization, control, and communication of ongoing curriculum changes at grade level through district level.

Our team has already spent several years developing a strong integrated curriculum around Social Studies, English, and Reading that has proved very successful for the students. These units employ a variety of strategies of which learning styles/Multiple Intelligence research are prominent. Utilizing the network and software now available will open access to this curriculum/these approaches, enable our team to improve our links to other disciplines, communicate our units/experience with current and new staff, and make curriculum changes rapidly. Finally, by employing this technology to communicate, by making it a foundation of our site's communication array, we will greatly increase the acceptance, education, and use of the new technologies for all parties: staff, student, and community.

A central curriculum database will allow all potential users to view and use the curriculum units developed by all staff. A teacher can review any teacher's lesson plan with the lesson's attendant hypertext links to the unit's scope and sequence, hypertext links to necessary resources, and hypertext links to example(s) of desired unit outcomes. Parents may also access the same information as a matter of general interest, or for the practical purpose of reviewing with their son/daughter, the current or past due assignments. This information would be available at school computers or through modem access to the curriculum server site. The same idea holds true for the student, who may wish to know his or her homework assignment, or may wish to review their electronic portfolio. We also view this curriculum database as a resource for the community as they can access (via modem) the site(s) for their children who are being home schooled or otherwise unable to attend school regularly. For students seeking an alternative method of high school course completion due to scheduling conflicts, the ability to link to curriculum will be a benefit. This program is intended to become a better demonstration of essential learnings mastery (outcomes based) for graduation than our current letter grading system, and to connect with new essential learning requirements.

While the curriculum database will be developed and maintained by staff, these electronic portfolios will be developed and maintained by students as part of their essential learning objectives. What is not directly produced by the students on a computer (mostly word processing) will be indirectly entered in the electronic database using scanning, and audio-visual equipment at our disposal. Maintaining the electronic portfolio will provide a record base that allows for better analysis of a student's progress during a year, or we hope throughout their school career. Teacher's can now build upon the same assignment outcome, extending the work to higher levels, creating in student's minds that the assignments have continuing value. Grades are temporary measures of progress towards skill mastery on the assignments, and the learning assignment continues on, not discarded to a waste basket. Having this portfolio improves the conversation between student/teacher, and parent/teacher, because there is a factual record to review products, and not just a grade. From the portfolios, a wider range of skills can be reviewed from our multi-faceted unit products, which a grade cannot reveal.

By combining both the electronic portfolios and the curriculum databases, we can review a student's progress, and chart an instructional approach that is not dependent upon the class as a whole. The student can be instructed to access the curriculum database at different levels to pursue units that are better suited to his/her ability. We see our development of these two interrelated database efforts as a forerunner to a district wide system that will allow students to tap into instructional content at different grade levels depending upon their individual mastery of skills. A high school senior may need remedial help from a middle school unit, or a middle school student may be in need of a challenge from a high school math unit. Measurement of either's success would be reflected in their electronic portfolio, which would also be a reflector of the district's essential learnings needed for graduation.

General Session: Technology Implementation/Educational Reform

Community-Based Planning: Leading Out Change for Technology and Learning

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Key Words: **community-based planning, planning committee, community-based technology**

> *No one can force change on anyone else. Unless it is experienced... by large numbers of people, change will remain a myth.*
>
> *—Eric Trist*

Some communities and organizations embrace new ideas that bring change, others do not!

How many new initiatives or great ideas can you identify that have been led by educators the last 25 years? How many of those efforts are still a significant part of the school's culture today? For many of us, too few!

No matter what planning approach a district uses, documents are created. But many become "shelf documents" that are under-funded, under-owned and under-implemented after their "plan" was completed. On the other hand, "living documents" are owned, funded and sustained throughout implementation even if the leadership changes or system barriers rise up against the new ideas and efforts.

Community-based planning is a process shell wrapped around traditional strategic planning stages that begins to create a "living document" for your schools. Three key elements are built into the Community-based Planning approach:

1. involvement of large numbers of people in the planning processes and decisions
2. creation of learning benefits for everyone, not just K–12 students
3. generation of enormous energy and enthusiasm for the whole system to individually take responsibility for decisions and actions needed to implement the vision

By involving large groups of individuals in shaping and implementing a collective vision, a context is created to move forward all decisions, work, challenges, as well as potential benefits. It unleashes your community's support and sustained commitment for upcoming change efforts by using large group interactive processes and events. This process generates a "barn raising spirit" that brings communities together to use their own wisdom in creating new stories of the way they will work and learn together when technology is infused.

Events are organized to engage the community in dialogues about their best hopes for technology and learning in their community. And collectively they begin to update their images of school and learning with scenarios that represent their preferred future. The common ground found in their stories shapes an agreed upon direction for technology and learning in their community.

This approach assumes not only a role for the community in planning but also tangible community benefits. We then begin to leverage resources in ways that break the myth that non-children families and senior citizens have no vested interest in supporting our schools.

Community-based technology planning gathers a group's best thinking from multiple perspectives as they learn together. Designing, managing the logistics, and facilitating large group events invite leaders to take on new skills in planning (see www.tcpd.org and follow links to Porter for more information). But the results from this planning approach give back major benefits as the success stories in Illinois, Hanau, Germany and other schools across the U.S. unfold. Because of broad-base involvement, the results continue even when the leadership changes or system barriers arise during the implementation phase. Instead of things collapsing onto a few committee members and leaders, everyone puts their shoulder to the wheel moving

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things forward anyway! And then… the planning committee will need to get out of the way of their own success.

K-16 Computer Science

Different Approaches to CS1

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Key Words: **CS1, closed laboratory, case study, GUI**

There is currently much discussion about the undergraduate Computer Science curriculum. With the rapid changes in computer science, the need to stay current is mandatory while the ability to develop and implement a contemporary undergraduate curriculum is extremely time-consuming and costly. The three schools represented on this panel each have a different model to undergraduate computer science education/the CS1 course. Each of us believes the work we have done has been successfully implemented at our home institutions. We also believe that these works can be successfully adapted by others. The purpose of this panel is to present these approaches and generate discussions on their commonality and their differences. With this discussion, we hope to help other schools who are interested in course and curriculum development. We can share our experiences, our curriculum models and our materials with others who are considering change.

Approach 1: Closed Laboratories—University of Virginia

As computer science grew as a discipline, undergraduate computer science education continued to change and, has for the most part, kept pace with the new topics in the field. However, the pedagogy has not changed significantly. Thus, we supported a shift of emphasis away from the traditional computer science curriculum. We believe that intense laboratory experiences which helps students develop inter-personal and engineering skills (in additional to learning course content), and provides real-world "practice" is important and needs to be a fundamental element of the complete curriculum. We have incorporated these concepts into our new CS curriculum. We have offered the new CS1 course for 8 semesters with good results; we have also developed and offered three follow-on courses. The student and faculty responses have been very favorable. They are excited by the new courses and the closed laboratory component. All of these courses have lecture slides, laboratory activities, homework assignments, etc. are available. A textbook for CS1 is also now available.

Approach 2: Case Study—Washington High School

The case study method, long used in fields such as business, medicine, and law, provides an effective method for teaching programming as well. Software engineering experts have recommended this approach as particularly appropriate for communicating design and development methodology and management of complex programs. Case studies have also been shown effective at the introductory level. Questions based on a case study will be included in the Advanced Placement Computer Science examination beginning in 1995. Textbook material that supports the case study approach is becoming increasingly available. This presenter's experience using case studies with Advanced Placement students has been most favorable. For the instructor, the best use of case studies requires a different approach: away from a final product and toward discussion of the process of solving the problem. Students seem better equipped to design solutions to other problems because of discussion involving the designs in the case studies. Students seem to be better at reading, understanding, and modifying code; and much better at producing their own high quality code earlier in the course. Not to be discounted, students actually enjoy the different approach!

Approach 3: GUI—University of Portland

Assumptions

- students need to learn skills and concepts.
- concepts are best learned in a context.

Important Concepts

- Software development—design, implementation, testing, etc., (focus is on design and implementation)
- Analysis (algorithmic and system)
- Events and GUI interfaces

Skills

- Java
- Software Development Environment
- Using Windows 95 Teaching Tools
- Labs and projects
- Modify existing code
- Create code from scratch
- Analyze performance

Traditional Poster Session

Electronic Partnerships: Bridging the School and Community

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Key Words: **Road Ahead Grant, SC State Museum, community partnership, afterschool program, mentoring**

Abstract

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A dynamic boost for Rice Creek's technological endeavors was the receipt of the 2-year $30,000 Road Ahead Grant administered through the National Foundation for the Improvement of Education and funded by Bill Gates and Microsoft. The Road Ahead provides grants, training, and mentoring on the use of telecommunications and multimedia technology to 22 teams comprised of public school teachers, staff, and administrators and leaders of community organizations. Rice Creek's Road Ahead Team, comprised of Joyce Pundt, teacher and team leader, Linda Hall, assistant principal, Diane Bowen, teacher and director of the afterschool and summer program, Phyllis Brown, technology specialist, and Linda McWhorter, Chief Curator of Education of the SC State Museum, was thrilled to be chosen as one of only 22 teams across the nation and the only one from South Carolina! The title of the proposal, "Highways and Bridges," was inspired by a statement made by Reed Hundt, chairman of the Federal Communications Commission: "The communications revolution should not be a highway—it should be a bridge between the world of opportunity and the world of despair." After one year of implementation, Rice Creek has discovered that the actual $30,000 is merely the tip of the strong structure of support that NFIE and Microsoft are constructing. Vital to the success of the nation-wide project are the capacity-building workshops/conferences of all 22 teams, the constant networking of the 22 teams, and the hardware/software support.

The Road Ahead Grant has also served as the impetus for two strong local partnerships within the Rice Creek Community: Rice Creek's "Just for Kids" (JFK) After-School and Summer Programs, and the South Carolina State Museum. The once limiting boundaries of school hours and the typical school year are now blurred as many students, including at-risk, are involved in exciting technological learning experiences beyond school hours. Successful summer/after-school scenarios include:

- 3rd-5th grade Journalism Club developing language arts skills while creating newsletters with desktop publishing software
- 2nd and 3rd graders predicting, plotting and graphing results (on computer) of their own school gardens
- 1st graders strengthening knowledge of geometry as they create computer drawing using shapes they have explored
- 4th and 5th grade Videography Mini-Camp in which students learned the mechanics and the art of videotaping
- 4th and 5th grade World Wide Web Mini-Camp in which students explored the Internet and made their own Web pages
- Museum Madness Club in which students gathered information about the various geographical areas of South Carolina and shared their interpretations on the Web

School walls no longer indicate boundaries at Rice Creek. The Road Ahead partnership with the SC State Museum goes beyond the typical field trips. Curators and teachers plan together for optimal field experiences. Communication between the school and museum is perpetuated through online sharing via WWW pages.

Naturally, undergirding all successes of the Road Ahead projects is the staff development of teachers. The grant funded a USC graduate technology course taught on the Rice Creek campus last semester. Thirty-six Rice Creek teachers signed up for only 25 slots!

Continuous challenges include maintaining a high level of technological competency of teachers as the faculty grows. (Rice Creek now has 99 faculty/staff and 925+ students!) Also, keeping up with hardware needs and cabling to portables is a constant need! In their journey on the Road Ahead, the faculty will continue to strive for true integration of technology in teaching and learning.

If you have Internet access, be sure to visit Rice Creek online:

http://www.scsn.net/users/Rich2/elem/ricecreek

Workshop

Using HyperStudio for Windows for Project-Based Learning

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Key Words: **HyperStudio, project-based learning, Windows stacks**

HyperStudio now has a Windows version. During this workshop the participant will have an opportunity to create HyperStudio for Windows stacks. Some example stacks will be illustrated along with a demonstration of how these stacks were created. Discussion will focus on how the use of multimedia, and HyperStudio in particular, can be used to "Spark the Student's Imagination." By providing multimedia development tools for their students, teachers can help them to use these tools as a framework to build their own knowledge.

One or two student-created projects will be demonstrated that show how the teacher can use these tools to create curriculum to provide large group and small group collaborative learning. Then the participants will have an opportunity to create some of their own stacks. The use of the Internet to provide reference materials for these projects and the incorporation of the Internet into these projects will also be demonstrated and made available to the participants as part of the workshop. Copies of demonstrated stacks will be provided to all participants.

This workshop is conducted by Dr. Dolores Pusins, Program Manager/Professor, Computer Science at Hillsborough Community College in Tampa, FL. Dr. Pusins has given workshops and presentations at previous NECCs. Dr. Pusins has been recognized by the Roger Wagner Company as one of their nationwide workshop leaders. Additionally, she has written two textbooks for West Publishing and is a contributing author to the Peter Norton's Computing Fundamentals textbook. Que E&T has contracted with Dr. Pusins to edit textbooks, write instructor manuals, and create PowerPoint presentations for several of their computer literacy books. She is currently developing a 25-lab interactive tutorial for their **Computers in Your Future** textbook.

Workshop

Using Microsoft's Internet Assistants to Author Web Pages

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Key Words: **Internet assistants, building Web pages, Web-publishing applications**

This workshop is a hands-on workshop where participants will have an opportunity to use Microsoft Office 97 Internet Assistants to create Web pages. These are free programs that work with Microsoft Office applications.

During this workshop, the participants will be introduced to the Internet Assistants for the four applications—Word, Excel, Access, and PowerPoint. In Word, they learn how to create the Web page, how to insert Hyperlinks, and then test these HyperLinks. Using the Excel spreadsheet program, they will learn how to create, edit, and convert spreadsheets for publishing on the Internet. They will next use the Internet Assistant for Access to create HTML documents from structured data for posting on the Internet. And with the PowerPoint plug-in, they will see how to easily convert presentations from slides into HTML format, and prepare their presentation to be published on a Web site. FrontPage will be utilized to bring this all together.

Additionally, the participants will be introduced to PowerPoint's Animation Player and Publisher. This free program provides an easy way to animate objects on their published Web pages.

This workshop is conducted by Dr. Dolores Pusins, Program Manager/Professor, Computer Science at Hillsborough Community College in Tampa, FL. Dr. Pusins has given workshops and presentations at previous NECCs. Dr. Pusins has been recognized by the Roger Wagner Company as one of their nationwide workshop leaders. Additionally, she has written two textbooks for West Publishing and is a contributing author to the Peter Norton's Computing Fundamentals textbook. Que E&T has contracted with Dr. Pusins to edit textbooks, write instructor manuals, and create PowerPoint presentations for several of their computer literacy books. She is currently developing a 25-lab interactive tutorial for their **Computers in Your Future** textbook.

Traditional Poster Session

Online K–12 Music Education: The Internet as a Collaborative Socializing Learning Environment

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Key Words: **music, World Band, electronic music, Co-NECT, collaborative, MIDI, motet**

The World Band music education program, in development since 1993, provides a successful model of how a collaborative online learning community functions. Students learn music by collectively building compositions; they use new electronic music tools and innovative pedagogical methods to constructively study the *what* of music rather than the traditional *how*.

Typical music courses in K–12 schools involve students who play a band instrument or the like. Rarely are the non-performing students given opportunities to excel in a topic area more than 80% (MENC 1994 statistics) of the student body is intimate with—that of music. World Band involves any student who has ears, a musical intuition, and basic computer skills.

Using a music MIDI-lab and standard e-mail file transfer methods, students develop collaborative compositions by trading music files with partners at distant schools. A methodical process teaches students about repertoire, form, orchestration, arrangement, harmony, rhythm, and melody. The process involves constructing and re-constructing a music work with many input styles. The tools allow even those with no compositional background or keyboard skills to begin creating original works of substance very early.

Constructivist methods focus on building upon prior knowledge while fostering experimentation. In an environment that avoids strict theoretical constraints, the students create freely, basing their developments on what they hear. Music theory is taught after completion of compositions and students quickly grasp the underlying concepts as they modify their works.

The goals include: developing educational models that stress contemporary music education ideas, create and sustain collaborative online learning communities; emphasize educational technology as a means to use resources thoughtfully, and excite a body of students who might otherwise be untapped for their contributions and abilities, producing culturally appreciative learners.

In many cases, desktop videoconferencing sessions have enhanced the communities and the teaching and learning. A new software tool *Interplay*, developed at BBN, allows the live performance between World Band sites and demonstrates the future of music performance across the globe.

Significant 1997 World Band activities include the Memphis Kids 'N Blues and the MOTET projects. Memphis Kids 'N Blues involves six elementary schools of the Co-NECT design (http://co-nect.bbn.com) studying the blues and producing an audio compact disc of original blues music. Funded by the Bell South Foundation, students study the history of the blues in year-long interdisciplinary project cycles through lyric writing, electronic music, musical styles, instrumentation and musicology. It will provide a model of arts-based interdisciplinary real-world product oriented projects.

MOTET (Music Online Telecommunications Environment for Teaching) merges live Internet performances with Web-based curriculum to teach contemporary music to non music students in K–12 public schools. (http://nsn.bbn.com/motet)

Music education will find a significant niche in the growing Internet world. World Band, currently involving 17 schools in 5 states and 3 countries, is providing substantial design research and curricular material for that niche. It has been endorsed by MENC, IAJE, and DoDEA.

General Session: Current/Emerging Technologies

Developing Knowledge Building Communities With Computer-Supported Collaborative Learning Environments

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Key Words: computer-supported collaborative learning, teacher change

Tools to Support Development of Knowledge-Building Communities

New tools to support collaborative intellectual work have transformed the ways that people work and learn together in business, science, government and other settings. These tools are now being introduced into K–12 settings but their use poses two challenges. First, for many teachers it requires a significant change in their role as teachers and the way they organize learning activities within their classrooms. Secondly, it requires that they learn to integrate network-based tools for collaborative intellectual work into the instructional process. Both of these challenges are addressed by Project CIRCLE (Community of Information Resources and Collaborative Learning Environments), a collaborative university/public school knowledge-building communities project funded by the U.S. Department of Education Secretary's Fund for Innovation in Education. The broad goals of the project were to: 1) create collaborative knowledge-building communities among secondary students, teachers, administrators, university faculty and students, and outside experts, 2) explore the use of networked environments to support collaborative learning; and; 3) model constructivist uses of technology in the classroom.

Project Description

The project involved the collaboration of an inner city high school (over 80% minority, low SES student population), a suburban high school and a college of education. A unique aspect of the project was the use of students as mentors and a support system for teachers in implementing the new network-based tools for collaborative learning. The project explored the use of networked computer technologies which support collaborative knowledge-building among learners and teachers as a catalyst to change the teaching-learning process. The participating high school teachers were provided with access, training and technical support related to network-based tools and environments to support collaborative learning including Daedalus, TeamFocus, FirstClass groupware and the Electronic Emissary.

Formal training sessions were provided to the teachers and students to introduce them to the collaborative software environments and learning models. Formal training for teachers was provided at the university and informal training and technical support was provided on-site. Teachers received training for each software tool (e.g., Daedalus) that included both the technical and pedagogical issues related to its use. Student mentors received training at the university on the same software application (usually during the week following the teacher training workshop). The student mentor training focused on the technical aspects of setting up and managing the software environments as well as strategies for mentoring teachers and students in the use of the collaborative learning tools. Both the teacher and student mentor training workshops included collaborative and team-building activities as part of the process. The student mentors followed up the training session by encouraging the teacher's use of the specific software tool and offering to set up the software application for the teacher's class and to assist them and the students in the use of the program.

University project staff provided on-site support for the duration of the project. The benchmarks for success for the project included: student engagement; changes in teacher practices; multiple simultaneous learning activities; improved quality of student work; collaboration between secondary school teachers, students, parents and university faculty and students.

Project Results

An outside research/evaluation team conducted observations, interview and surveys of participants and comparison studies with other classes in the high schools. A special instrument was developed by the research team to determine student perceptions of classroom knowledge-building (SPOCK).

The findings indicated that the use of computer-supported collaborative learning (CSCL) network-based tools, training and support yield significant increases in collaborative learning activities, higher-level question asking by students and strong increases in perception of collaboration with fellow students (even in the schools that already had an emphasis on collaboration). The results also provide evidence that the knowledge-building community approach can help teachers to change instructional practices and pedagogical framework from teacher-centered to student-centered. Lastly, the results indicate that use of computer supported collaborative learning in the inner city high school can produce significant increases in performance on traditional measures, such as the Texas Assessment of Academic Skills test, compared to other classes in the school.

Another important finding of the study is the demonstration of the effectiveness of the use of students as technology mentors for teachers and as a support system and a catalyst to get teachers to use the new technological tools within their classes. Many of the teachers reported that, despite what they perceived as very effective training, they still felt insecure in taking that first step in using the technology with their class. There was a lingering fear that they would make a mistake and that it would not work or go well. The student mentors took away much of the risk from the teacher by enthusiastically volunteering to set up the network and or software program for the class activity. The students demonstrated little fear of failure and persisted until they solved the problem and were able to make the specific computer-based application fully operational.

The following are some of the observations and results of the use of student mentors to support the teachers in implementing computer-based tools for collaborative learning:

- a large number of teachers not directly involved in the project have requested that they be assigned a student mentor during the coming academic year;
- the student mentor training has now become formalized into a regular class (with academic credit) within the inner city high school;
- the use of the high school student mentors has now extended to include the mentoring of middle school teachers and students in technology applications;
- teachers and student mentors have both noted positive changes in the role and relationship of student mentors not only with the teachers but with students in the class;

- teachers and students from the inner city school reported that the student mentors (from the predominantly Hispanic, low income student population) had few aspirations for higher education before the project, but many have now indicated that they would go on to higher education after completing high school.

On the results of Project Circle it is recommended that schools consider the use of CSCL tools and high school student technology mentors for secondary teachers as part of a strategy to transform the teaching-learning process.

General Session: New Curriculum Designs/Instructional Strategies

Developing Native American Community-Based Curriculum Resources Using VR Technologies

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Key Words: **virtual museum, Native Americans, QuickTime VR**

The 4Directions Project

For many years, Native American culture was undervalued and suppressed in America. Although the richness of Native American historical and contemporary culture has begun to be recognized, exemplary curricular materials based on this richness are rare. In addition, in a rapidly changing world, much traditional wisdom will be lost before there is an opportunity for Native American students to learn about their own history and culture, and to share what is sharable with the world community. Teachers trained in methods of cultural sensitivity and in the use of technology may provide leadership in the accessing, preserving, sharing of Native American culture with the world community. 4Directions is a five-year education project, now in its second year, receiving major funding through The U.S. Department of Education Challenge Technology Grant Program. The project includes 18 Native American schools covering the "four directions" of the continental United States, in South Dakota, North Dakota, Minnesota, Michigan, Maine, Florida, New Mexico, Arizona, and Washington.

The Virtual Museum Initiative

One approach to curriculum materials being explored by 4Directions is the production of Virtual Museums of the Native American cultures using multimedia tools, CD-ROM technology, and QuickTime Virtual Reality (QTVR) to create a media-rich record of each community's way of living, past, present, and future. By engaging in a community-based Virtual Museum projects, each school may see several possible outcomes:

- Students learn about their culture and community by gathering information, interviewing community members, and creating media products.

- Students learn about new media such as multimedia programming, HTML, and QTVR. These skills may be applied to learning projects in all school subjects.
- Students become motivated using exciting technology and engaged in learning activities that are relevant to their lives.
- The products of multimedia student learning projects may be organized into WWW pages and CD-ROM titles that may be used as curriculum materials by other students.
- High quality Virtual Museums may be installed in interactive multimedia kiosks in tribal, regional, and national museums.
- Virtual Museums may become highly valued documents of Native American heritage.

In the first two years of the Four Directions project, the Virtual Museum initiative has been focusing on training teachers and students to do digital and film photography for QuickTime Virtual Reality.

What Is QuickTime Virtual Reality?

QuickTime Virtual Reality (QTVR) is a new media that simulates spaces and objects using photography. There are two kinds of QTVR: panoramas (panos) and objects. Panoramas are shot by placing a camera on a tripod and taking overlapping pictures at equal angles through 360°. Special tripod heads make mounting, leveling, and accurate panning easy. The pictures are seamlessly "stitched" together and turned into pano movies using QTVR software. One may use the mouse and keyboard to look around and zoom in and out within the virtual space of the panorama. Object movies are made with a stationary camera focused on an object set on a turntable and shot at equal angles as it is rotated through 360°. The stills are assembled into a QTVR object movie. By placing a cursor on an QTVR object and holding down a mouse button, one may turn the object around to examine all of its sides, as if holding it in one's hands.

Current Successes and Future Plans

Our approach has been to scaffold the learning process by showing teachers and students how to follow "cookbook" approaches to producing QTVR media and providing online technical assistance with the more difficult aspects of the technology until the schools feel comfortable with taking their skill and knowledge to the next level of difficulty. Three schools that have received QTVR "kits" have responded well to this approach. These schools are producing their own QTVR objects and doing the digital photography for QTVR panoramas.

A QTVR production Internet "pipeline" has been set up between the 4Directions schools and the University of Texas for QTVR panorama production. Students shoot the pictures for the panos and upload them to the University, where they are downloaded, stitched, and converted into QTVR panos. The University is able to give a 2 or 3 day turn-around on panoramas, so that students receive timely feedback on their QTVR pano shoots. We have noted that the skill of the students increases quickly, and their enthusiasm for this new medium remains high. Since it was introduced at the 4Directions Summer Institute in 1996, interest in the Virtual Museum initiative has grown. Many 4Directions schools will bring articles to the 1997 Summer Institute to turn into QTVR objects. More QTVR kits will be distributed to the schools for shooting panoramas this year, and hands-on training will be offered at the Summer Institute. Training will be expanded to show schools how to incorporate QTVR media in Web pages and HyperStudio stacks and how to stitch QTVR panoramas.

Future plans include introducing more of the 4Directions schools to QTVR and increasing the knowledge and skills within the schools that have already adopted the technology. A long-term goal is the use school-created materials produce a professional-quality CD-ROM: the 4Directions Virtual Museum.

General Session: New Curriculum Designs/Instructional Strategies

Authentic Learning in Authentic Contexts: Learning Hypermedia Through Community Study

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Key Words: **alternative assessment, project learning, cooperative learning, teacher education, community study, hypermedia, Internet**

Technology courses, taught in the teacher education curriculum as stand-alone courses, often advocate integrating technology with other content areas while failing to model curriculum integration for students. Teacher education classes have a responsibility to model reform-based teaching practices including integrated curriculum, cooperative learning, authentic project-based learning and alternative assessment if novice teachers are to thoroughly understand and be expected to implement such practices in their classrooms. A graduate university summer technology course for a cohort of 24 promising novice elementary teachers in the use of hypermedia and Internet resources provided a superb opportunity for an authentic constructivist learning project. Course instructors designed the course to meet authentic needs of the novice teachers who would become full-time first-year teachers in the fall.

The technology course had three major objectives: 1) to help novice teachers develop multimedia skills that they can use with students in their classrooms; 2) to help novice teachers develop a school community knowledge base including a variety of community resources; and 3) to model the use of authentic project work, constructivist learning theory and alternative assessment strategies.

The course required the novice teachers, working in teams of 3, to use cooperative learning strategies to conduct a study of the community to which they were assigned to be classroom teachers in the fall. The community study focused on learning about important resources, services, historic landmarks, cultural and ethnic makeup and other aspects of the community. The novice teachers made numerous community visits, conducted interviews and collected data using digital cameras, video cameras, tape recorders and field notes. They used this data in constructing HyperStudio projects describing their own school communities. The district novice teacher teams engaged in a tremendous amount of teamwork for planning, investigating, recording and processing data through print and graphic displays.

The second technology project was one in which the novice teachers worked in cooperative groups to produce an Internet resources newsletter. Novice teachers formed grade level teams to explore age and grade-level appropriate Internet and Web resources. Grade level teams identified and summarized the resources and wrote their ideas for classroom application. Each team's work was imported into a newsletter template. The resulting multipage newsletter was duplicated and distributed to all participants on the last day of class.

In order to model alternative assessment, prior to beginning the hypermedia community study and Internet projects, the novice teachers were provided with performance tasks and rubrics which clarified and defined the content and communication standards and scoring criteria for each of the two projects.

Instructional strategies used in the course included project work, cooperative learning, performance assessment, storyboarding, semantic Webs, and community building activities. Multimedia tools used in the course included HyperStudio, digital camera (QuickTake), video camera, Clip Art, and Netscape as well as word-processing tools such as Microsoft Word and ClarisWorks. While the course offered instruction in a variety of software tools, they were not taught as discrete bits, but rather in service of constructing an authentic meaningful product.

The course culminated with a "Day of Celebration" during which each district team presented their community study and each grade level team presented their Internet resources newsletter project to an invited audience including teachers and administrators from the participating school districts.

In reflective final exams, the novice teachers reported that the project descriptions and rubrics helped them develop high quality products because performance standards and expectations of quality were clearly defined. This experience helped lay the foundation for the graduate assessment course which these graduate students were to take during the spring semester of their masters program. Through this "technology" course, the teachers gained a head start in learning the concepts of alternative assessment modeled through the authentic projects and assessments.

Novice teachers in this course were engaged and diligent in their work due to the authenticity of the project. They recognized that they would be expected to be knowledgeable about the communities they were entering for their first full-time teaching assignment and were, therefore, willing to put a great deal of time and effort into their research and presentation. They knew that the invited audience would include members of the community that their project described and recognized the need for accuracy of the information contained in the presentation.

In follow-up conversations in the fall, following the summer technology course, the novice teachers reported that they entered their new districts feeling confident that they had developed a necessary knowledge base of important community resources. Mentor teachers also reported that the novice teachers were recognized by their faculties for their multimedia expertise and within the first year of teaching, demonstrated leadership in educational applications of computers multimedia development.

General Session: New Curriculum Designs/Instructional Strategies

Online Curriculum Development Activities

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Key Words: online curriculum activities, telecommunications

Abstract

This session will provide an overview of several online curriculum activities that focus on interaction between students in many parts of the world. A model for developing similar student projects will be demonstrated.

Summary of Program

The Education Network of Ontario (ENO) provides a variety of telecommunications services to the educational community. Everyone who works in the education system in the province of Ontario is eligible to become a registered user with an account on the network. This includes teachers, support staff in schools, school board personnel, Faculty of Education students and staff and officials of the Ontario Ministry of Education and Training. Students are now part of our active list of participants. They are involved in curriculum projects that allow them to work with students from all parts of the world.

Curriculum activities have been developed by ENO to encourage appropriate use of the Internet by students. These activities have been developed using a basic framework that can be applied to other curriculum projects. Several of these projects will be highlighted during the session. The template for the development of online curriculum projects has allowed teachers to take their traditional classroom activities and make them more interactive. The template covers topics such as:

- timelines
- expected outcomes
- suggested activities—on and off the computer
- specific online activities
- mentor roles
- resources
- evaluation and tracking strategies

During the session, a demonstration of ENO will provide delegates with a first-hand glimpse of how Internet resources, Web-based conferencing, individual student and guest accounts are used to facilitate learning. Results of the several projects will be shared.

General Session: Technology Implementation/Educational Reform

Adding Value to Courses With Online Support

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Key Words: **Internet, faculty development, training, World Wide Web**

Introduction

Few faculty use the Internet for course delivery. This is generally due to the fact that universities hire faculty primarily for their content expertise, not their Internet programming skills. The time and effort required to surmount technical hurdles, such as mastering HyperText

Markup Language (HTML), prevent many faculty from attempting to publish course materials online. In the recent past we have not expected faculty to master all the crafts, such as typography, page layout, and offset printing, needed to deliver their print-based course materials; universities and publishers provided these services.

The World Wide Web presents a different situation. For the moment, at least, the Web has removed intermediaries between faculty authors and student readers. Web publication appears, on the surface, to be merely an extension of word processing (a technical skill itself, which, we should remember, we have come to regard as a "baseline" skill for faculty only in the past decade, if at all). Web publication, however, is in a difficult stage of development. At its best, it is not merely an extension of word processing, but a new, interactive medium of instruction. Taking full advantage of the Web's interactive capabilities requires much more than word processing skills. Yet we often assume that faculty who want to "stay current" can and should become competent Web authors.

To assist faculty in Web development, the authors of this report submitted and received a grant from the California State University's (CSU) Chancellor's Office to train faculty from each of the 22 CSU campuses in a workshop designed to wed innovative pedagogical techniques with new models of distance education. The purpose of the Institute was to provide easy-to-implement methods whereby faculty could rapidly and easily create and manage Web-based course materials to add value to existing courses. The strategies we used center around three components: tools to facilitate rapid creation, development, and management of Web-based course materials; techniques to enhance online teaching; and training to help distribute the ideas of the Institute throughout the CSU system.

Tools

Although many faculty believe the Internet is becoming an important means of communicating and delivering information to students, many feel overwhelmed by the rapid evolution of the medium, and fail to envision how they can use it to their advantage. To help faculty overcome these obstacles, we created a series of Web-based tools and templates that, when completed, provided many of the necessary components of an online course. After examining current practices of both online and traditional course delivery we designed templates for creating a personal home page, course home page, course syllabus, course schedule, Web-based student inquiry activities, and reflective questioning

We made the templates available online as forms which prompted users through a series of questions, then automatically created relevant Web pages based upon the submitted information. Users can view and save the document source to obtain the HTML code. As faculty complete the templates, they have a basic, but fully developed, ready-to-run custom Web site for their course.

Techniques

The Institute also engaged faculty in further customization of their site through both innovative and traditional learning activities. To this end, we created a five-module online course which included the techniques and strategies to help faculty develop and manage their own online course modules. Online resources and instruction were provided through course documents, asynchronous forums, synchronous chats, instructional multimedia, e-mail, collaborative design, exchange and critique of electronic documents, and online assessment.

Course content and modules center around five major topics: strategies and tactics for online teaching and learning, document preparation for online courses, online student learning activities, nourishing an online learning community, and management of online course resources.

Training

The Institute combined the dissemination power of a "train-the-trainers" approach with the instructional effectiveness of coaching and mentoring in a "peer coaching" strategy. Our plan was scheduled to operate in four tiers.

First, we recruited one participant with at least a base level of experience with online course development from each of the 22 campuses to serve as an on-campus mentor or coach. After training, each campus coach in turn spent a total of 15 hours supporting three other faculty on their own campus, one-on-one or in small groups, as they participated in the online course.

The second tier training occurred when the three secondary participants at each campus began the five online modules. The previously-trained campus mentors provided coaching for these participants: The Institute provided back-up support for both coaches and participants. Each of these second tier faculty were responsible for recruiting, training, and a total of 15 hours of coaching for three additional faculty members through the online course.

In the third tier training the 66 second-tier faculty members each assisted three additional faculty members as they completed the five online modules and develop online course publications and activities.

This model optimized the potential to reach faculty in a significant way throughout the CSU system. The initial mentor, three participants, and nine additional faculty participating at each campus totaled 286 faculty who could create online materials for students in one or more of their courses by the end of the Institute.

Summary

In many locales, private enterprise and distant universities are beginning to make inroads into the delivery of instruction through electronic delivery formats. Local institutions that are slow to respond may find that their traditional clientele are no longer required to settle for the nearest facility, and may instead turn to those institutions that provide the most expedient material. Our purpose of designing this Institute was to add value to the work done by university faculty; for these people to identify and implement methods to improve their course offering through new methods, strategies, and media.

A previous, more detailed version of this document appears in the Technology and Teacher Educational Annual, 1997, published by the Association for the Advancement of Computing in Education.

General Session: Technology Implementation/Educational Reform

The Microsoft Authorized Academic Training Program

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Key Words: **Microsoft Authorized Academic Training Program, technical proficiency, Microsoft Official Curriculum**

The Microsoft Authorized Academic Training Program (AATP) is an offshoot of Microsoft's industry education arm, Microsoft Training and Certification. AATP is for accredited academic institutions that wish to offer technical training that meets the employment demands of the local community and the global technology marketplace.

AATP institutions deliver a vocationally oriented curriculum that is based on emerging Microsoft technologies for application development, and server application and networking platforms. The Microsoft Official Curriculum and Microsoft Approved Study Guides used in these courses provide your faculty with ready-to-use course material and hands-on labs based on a consistent training model for Microsoft technology.

This training is for those who wish to become, or polish their skills as, software developers, network administrators or systems engineers. It teaches students how to develop, support, and integrate computing systems with Microsoft products such as the Visual Basic programming system, the Visual C++ development system, or the Windows NT™ and Windows 95 operating systems. It also helps students prepare for Microsoft Certified Professional exams. By passing Microsoft Certified Professional exams, your students can earn a marketable credential that validates their technical proficiency with Microsoft product.

Benefits of the Microsoft Authorized Academic Training Program

You will be providing your students with the technical education demanded by your community and the technology marketplace as a whole. As an AATP institution, you receive the following benefits:

Top-quality training. Your school can offer training that the job markets urgently require, which means your students are more employable in a variety of technology-based jobs and industries-and your school is more marketable to students looking for top-quality technology training.

Preparation for certification. Your AATP-conducted courses prepare students for certification, a "must" credential in the high-technology industry.

Community recognition. You can increase your value in the community by teaching industry-recognized courses.

Leading-edge products. Offer training on new Microsoft products as soon as the products are released-putting your institution on the leading edge of technology training.

As a Microsoft Authorized Academic Training Program institution, you also receive:

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Microsoft Certified Product Specialists have demonstrated in-depth knowledge of at least one Microsoft operating system. Optional specialties are also available on Microsoft BackOffice™ products, development tools, or desktop applications. Many MCPSs use this certification as a stepping stone towards one of the following certifications.

Microsoft Certified Systems Engineers are qualified to effectively plan, implement, maintain, and support information systems with Microsoft Windows NT and the Microsoft BackOffice family of server software.

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- Microsoft Office and Microsoft BackOffice.
- Microsoft Official Curriculum and Microsoft Approved Study Guides.
- Microsoft AATP institutions provide students with industry-recognized training through the use of Microsoft Official Curriculum and/or Microsoft Approved Study Guides.

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Microsoft Official Curriculum are courses developed by Microsoft on developing, supporting, and integrating computer systems using Microsoft products. These courses help prepare students to take the appropriate Microsoft Certified Professional exams, which test candidates for the highest levels of Microsoft product knowledge. Although Microsoft Official Curriculum was originally developed solely for commercial delivery, many academic institutions have found it applicable with some augmentation. The major benefits of Microsoft Official Curriculum are that it is timely to product releases, is developed by the Microsoft product development group, and maps directly to Microsoft certification exams.

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These are self-study and classroom textbooks developed by third-party publishers, called Microsoft Independent Courseware Vendors. Microsoft Approved Study Guides are based on the objectives of the Microsoft Certified Professional exams. These study guides have been carefully and rigorously reviewed and approved by Microsoft as an effective method to prepare for Microsoft certifications and prominently display the Microsoft Certified Professional logo. Although not directly developed by Microsoft, these materials have received Microsoft's stamp of approval and in some cases the layout may be more conducive to academic delivery.

How to Participate in AATP

If you would like to participate in the Microsoft Authorized Academic Training Program, review the Microsoft Authorized Academic Training Program Application Kit. It contains complete information about the Authorized Academic Training Program, and a program application and agreement. Here's how you can receive a copy of the application kit:

Ask for an AATP Application Kit by calling:

1-800-508-8454

or e-mail aatp@msprograms.com

You can download an application kit from the Internet:

http://www.microsoft.com/channel_resources/ aatp.htm/

General Session: Technology Implementation/Educational Reform

Intranets: The World Behind the Firewall

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Key Words: **Intranet, Internet, virtual libraries, networking, hypertext, electronic portfolios, multimedia**

This presentation will discuss the way the recent development of intranets for use in the corporate environment provides an emerging model for schools seeking to use computer-based TCP/IP network communications technologies and the Internet in the classroom. Intranets are, in essence, self-contained Internets which use Internet WWW technology within the organization, although connection between an Intranet and the Internet is also possible.

Intranets mimic the way the Internet is used but are designed for accessing information within an organization. At the heart of the Intranet is the Web server which will store, manage, index and deliver a variety of file types and information using Internet protocols such as: FTP (file transfer protocol); HTTP (hypertext transfer protocol); SMTP (simple mail transport protocol); and HTML (hypertext markup language). Web technology is based on open standards and therefore doesn't lock schools into limited, costly choices. In fact, Web technology is available for nearly all leading operating systems and hardware platforms. Internal Webs can connect the different types of computers on a network, be they PCs or Macs. The Internet technology on which these internal Webs are based makes it possible for any computer to display a document, no matter what kind of computer created it.

Another advantage is ease of use. One of the most fundamental technologies driving more and more people to use Web technology is hyperlinking. Hyperlinking allows users to navigate easily and find information by simply clicking on a word or graphic. In addition, with Web clients such as Netscape Navigator, a single front end is used to access all internal and external resources therefore users don't need to learn multiple software packages. Hypertext markup language (HTML), the development tool for the Web, is becoming easy to produce. Future word processing and page composition software will automatically generate HTML. For students and teachers ease of use is a critical factor if an educational information system is to be utilized to its fullest potential.

Cost-effectiveness is another advantage of using Web applications. These tools are surprisingly inexpensive in initial purchase, training, and deployment. Netscape offers its Web utilities free of charge to educational institutions.

Direct connection to the Internet offers students and teachers access to large amounts of valuable information. The problem with the Internet is that finding information in a timely manner can often be difficult. Decisions must be made as to how much time educators want students to invest in information access and use. The construction of internal Webs allows schools to create their own "virtual libraries" of materials existing on the Internet in the public domain which can be archived locally for use by students and teachers on demand. This helps to reduce the loss of instructional time due to connection problems or delays in locating the desired information. The "information age" has inundated people with data that is often out of date, incomplete, or irrelevant. Instead schools need, and internal Webs can provide, a way for educators to access the information they want, when they want it. Another benefit of internal Webs is that they eliminate many of the problems faced by schools with limited connectivity and concerns about objectionable materials that students might find on the Internet. Internal Web systems can provide information in a way that is immediate, cost effective, easy to use, rich in format, and versatile. If a computer is not linked to the Web, it can still use archived documents in HTML format by installing a Web browser on that machine. Thus, stand alone computers without a modem or network connection can be used as "information kiosks" to serve up archived Web documents in the classroom.

The use of the Internet in schools is one of the most promising developments technology advocates and members of the educational reform movement have seen in recent years. Though the current version of the World Wide Web is interesting enough, the prospect of Web-based architectures within schools is perhaps even more exciting. The Web offers a model for the way schools will display student projects and access instructional materials in the future. New opportunities for collaboration between students and teachers worldwide can take place by encouraging the exchange of hypertext multimedia projects between schools. A school could have, as it were, its own internal Web content offerings—only some of which would be accessible to outsiders. Other secure materials could be offered to select individuals such as parents wanting to view their child's latest additions to his or her electronic portfolio constructed in hypertext, home work assignments, student records, or the school events calendar. Just as we now navigate through Web servers worldwide, we could then navigate through a range of information available on the school's internal Web server.

General Session: New Curriculum Designs/Instructional Strategies

If Everyone Had One: The Learning With Laptops Initiative

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Key Words: **laptops, research**

The Learning With Laptops Initiative is a collaboration of more than 25 schools planning to demonstrate the educational value of providing every student in a class or grade level or school building with a laptop computer. The Learning With Laptops Initiative builds on demonstrations of effective integration of laptops in Australian schools and adds the opportunities of new software packages and unique online collaborations. The sample of participating classrooms includes a sufficiently large group—each providing slightly different context for learning—so that a panel discussion with representative participants can explore the variations in what laptop access can contribute to student learning and instructional practice.

Classrooms in the Project are spread across 13 states. Some schools have selected a particular classroom or a grade level to participate in the Project; other sites involve the entire school building at once. The participating schools portray the full educational range—both public and private schools, elementary, middle, and high schools; each of these grade groupings (and student populations) have approached the use of the technology differently. Moreover, some classrooms are acquiring the technology with public funds; other classrooms are asking parents to provide the resources. This complex mix of demographics and interests results in a test bed of ideas.

Microsoft, Toshiba, and local resellers are collaborating to provide schools with laptops and software at reduced cost, to conduct staff development for teachers, and to offer technical support for both school networks and Internet connections. ROCKMAN *ET AL*, an independent education research firm, is conducting an evaluation of the Laptop Initiative. We propose presentations by representatives of three participating schools and a discussion of the broader perspectives and outcomes by the research team. We will explore the experiences and outcomes of the Initiative, specifically:

- In what ways did the introduction of laptops into the classroom change the way teachers teach and how has the curriculum changed?
- How did the introduction of laptops change the school culture and how will teachers institutionalize the use of laptops into their instructional program?
- How have students changed the way they attack problems in school and out?
- What were the barriers teachers and students had to overcome during the project year, and what is the scaling up process?

General Session: K–16 Computer Science

Using Graphics to Get Kids Hooked on Programming

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Key Words: **programming, graphics, Turing, secondary**

Why Start With Graphics?

Graphics is an exciting area of computer science. Students are exposed to computer generated images and animation everyday. It is an ideal place to start learning programming.

Traditionally, programming has begun with explanations/examples of the number crunching capabilities of computers. Although this is an essential part of programming, it has been our experience that graphics is a better first unit because it motivates and excites our students.

The Programming Course

Our Grade 11 programming course is composed of the following:

Unit 1—Graphics and Fonts
Unit 2—Loops
Unit 3—Procedures, Functions and Concurrent Processes
Unit 4—Selection
Unit 5—Arrays and Files

Graphics is used as a base to teach all the other units. At the same time, other concepts are introduced at appropriate points (variables, mathematical and comparison operators, string manipulation, etc.). Projects and exercises are assigned at the end of each unit. Homework and assignments are assigned at the end of sections in each unit. Answers to questions in the units are included at the end of each unit.

The Object Oriented Turing Programming Language

These units can be taught using any computer language. We have chosen the OOT language because it is "friendly," highly structured and powerful. For more information about OOT, visit http://www.holtsoft.com. Both teachers and students at our school are very satisfied with the use of this language in our courses.

Although, object oriented programming is not introduced in the Grade 11 course, it will be easy to introduce it in the Grade 12 course since we would not have to change languages. Concurrent processes is introduced in Unit 3 of the Grade 11 course.

If you are interested in looking at the units (approximately 140 pages), please visit us at http://cs.dprcssb.edu.on.ca/ndss/turing. The units are viewable online using Adobe Acrobat Reader 3.0. They can also be downloaded in PDF format (read-only). You may use the units (or modify them to suit the language of your choice) in your classroom. The units are free, the only thing we ask is that you make a donation to charity in your city or town or to one of the charities suggested on the Web page. The content of the units are reviewed every year, so they do change and get updated.

General Session: New Curriculum Designs/Instructional Strategies

Using Multimedia to Expand Portfolios to Student Resumes

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Key Words: **portfolios, multimedia, student-directed learning, authoring**

Electronic Portfolios as an Assessment Tool

According to Crouch and Fontaine (1994, p. 306), the term "portfolio is defined as a selection of assignments that a student has consciously assembled from a number of pieces produced over a semester or some other period of time." Most of the literature on the use of portfolios focuses on their use in the elementary grades as alternative assessment vehicles. In the elementary grades, they have been found to be effective in helping the teachers make instructional decisions in the classroom (Dewitz, Carr, Palm, and Spencer, 1992). A review of research in the use of portfolios in mathematics learning showed that they enhanced students' mathematics learning and communication about student progress among teachers, students, and parents (Cicmanec and Viechnicki, 1994). However, in the Vermont statewide performance assessment of portfolios, this positive impact on instruction contrasted with empirical findings about the quality and reliability of performance data the program gave (Koretz, Stecher, Klein, and McCaffrey, 1994). In the university setting, portfolios are being used for assessment in many areas including writing, education, and business communication (see Bacon and Bloom, 1995; Reilly et al., 1993).

This paper discusses a technological enhancement of traditional portfolios, electronic CD-ROM portfolios. There have been few studies that have considered the use of multimedia portfolios as an assessment tool. Gamon and Robinson (1996) discussed the use of electronic portfolios as a measure of the professionality of student teacher candidates at Eastern Washington University. Teacher candidates leave the university with a electronic CD-ROM, which contains a comprehensive outline of their accomplishments, teaching experiences, and evaluations. The authors do not assess the effectiveness of this tool; rather, they focus on its use by administrators and teachers. Others have discussed the use of electronic portfolios as professional resumes and digital student projects (Fasick and McLaren, 1995; Milone, 1995).

Techniques

As part of the requirements for graduation in the DDM area of concentration, students were required to complete an electronic portfolio (resume) of their academic and work experiences. The students were given instruction and examples of previous electronic resumes. All students received the same guidelines for their resumes. The following information appeared on the course syllabus.

You must design, produce, and press a CD-ROM version of your electronic resume (or other equivalent document if approved by the professors). This resume should include samples of your work as well as "traditional" resume information. It must be authored on the DOS/Windows platform using the application Authorware. Also, it must include a minimum of 1 video file (QuickTime, VFW, or Animation) captured by the student, 2 sound files, and 4 pictures taken by the student (these can be scanned or downloaded using the QuickTake camera). Your Authorware project must include the following: interactions, frameworks, movies, sounds, and external libraries. You must provide cover art and installation instructions for your resume in addition to the actual multimedia files.

Results

Fourteen students completed the first offering of Industrial Studies 189: *Document Production and Control Seminar* during the Spring 1996 semester. In evaluating the final electronic resumes, the resultant electronic resumes fell into three distinct groupings: traditional resume—4 students, extended traditional—4 students, and full multimedia—6 students.

Group 1: The "traditional resume." This first group of electronic resumes maintained the paradigm of the traditional, paper-based resume and did not include many details nor multimedia features. Figure 1 shows the main menu page from one of the student's projects in this group. In considering this figure, one can see that the design is simplistic with little interaction or special effects.

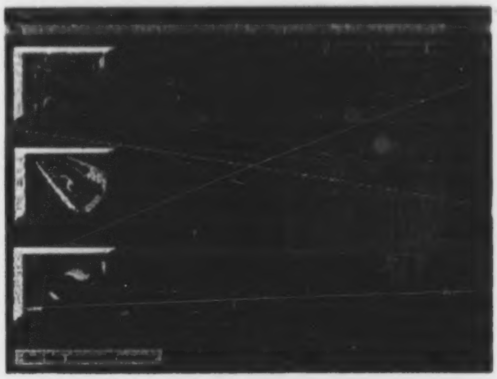

Figure 1. Screen Print, Main Menu, Sample Resume in Group 1

Figure 2 shows one of the subsections in the same student's resume (the section entitled "Academic" on the main menu). As indicated in Figure 2, the students in this group maintained a "traditional, paper-based" paradigm despite authoring in a multimedia environment. In general, they included the exact same categories as their paper resumes and limited the information in each section to that found on a traditional resume. Although most of the students in this group fulfilled the minimum requirements for this assignment, there was little attempt to include additional features or multimedia elements into their electronic resumes.

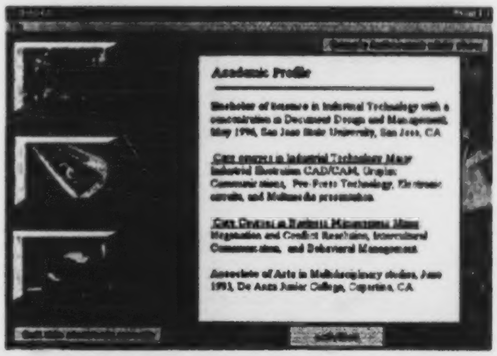

Figure 2. Screen Print, Sample Resume in Group 1, Section "Academic"

Figure 3. Screen Print, Main Menu, Sample Resume in Group 2

Group 2: The extended "traditional resume." The second group of resumes maintained the structure of the traditional resume but expanded each section including multimedia features such as videos, sounds, and/or graphics. An example of this group of resumes is shown in Figure 3. The interface designs of this set of resumes also were simplistic with few features and details. In this way, they were similar to the resumes in group 1. The differences in this group can be better seen in Figure 4, which shows one of the subsections (Education) in this resume. This student added more multimedia features to his resume than did students in the first group. Both of the two photos that appear on Figure 4 were animated and added more complexity to this multimedia document.

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Figure 4. Screen Print, Sample Resume in Group 2, Section on Education

Group 3: The multimedia resume. The last group of resumes broke with the traditional paradigm and recreated new structures. Figure 5 shows the main menu of one of the students in this group. This particular student is typical of this group in the amount of complexity she included in her electronic resume. Prior to her main menu appearing, she had an introductory animation with her name being dragged out. Other students in this group either included videos of themselves or other multimedia features to preface their interface.

Figure 5. Screen Print, Main Menu, Sample Resume in Group 3

When one considers the subsections of this resume (and others in this group), they are more complex than the other two groups. Most of them include subsections (or categories) in each section. This allows the user to have more options and make more choices. Figure 6 illustrates this design factor. (Figure 6 represents the options under **Track 3: Portfolio** in Figure 5). Instead of having a simple screen or buttons to show each subsection, this student used a pictorial approach, a metaphor of an art gallery to show her portfolio. In addition, she included an introductory video in this section to explain how to operate this section. Also, a perpetual video logo of her name ran continuously in the top, right corner of her screen.

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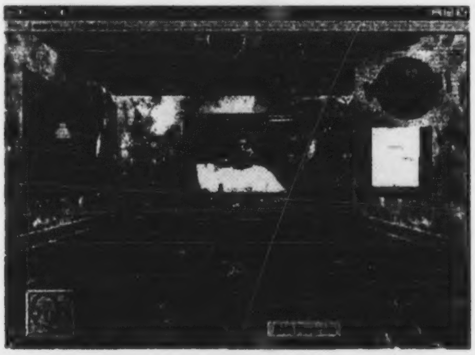

Figure 6. Screen Print, Sample Resume in Group 3, Track 3 Portfolio

Educational Importance

The major theme throughout this paper deals with the infusion of high technology and multimedia instructional modes into the professional educational curriculum. This paper showcases one technique for promoting student learning and achievement. The development of portfolios by students is not a cursory process. In order to be effective, portfolios require students to become self-reflective and view their work as a whole rather than as unrelated pieces. Electronic resumes, as natural technological outgrowths of portfolios, can expand this active process further by encouraging students to express themselves visually as well as in written form. In addition, this study shows that the use of electronic portfolios brings learning that is interactive and socially based. Although unplanned by the instructors, students freely collaborated with each other, both in designing the multimedia as well as critiquing the content. This student-directed, collaborative learning possible is the best outcome of this activity.

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General Session: New Curriculum Designs/Instructional Strategies

2025: A Virtual Fair of the Future

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Key Words: **curriculum, future, digital, multimedia, Internet, World Wide Web**

Description

What will our school, the community, the oceans look like in 2025? See the future through the eyes of Fourth Grade students who developed a World Wide Web Site in a restructured, full-day multimedia digital classroom.

Session Objectives

- Inform attendees on how a complete restructuring can be accomplished with support from Administration, Parents, Community
- Demonstrate how a classroom can be transformed into a cooperative "digital workplace"
- Demonstrate how students can experience the curriculum via projects that are active and meaningful
- Explain how, through technology restructuring, students learn real-world skills

Structure

Session attendees will participate in an interactive discussion about how the technology facilitated the project and how the required curriculum was successfully completed.

- Introduction by Beth Wiele Austin Rd Teacher-and Mark Samis of BOCES
- PowerPoint Presentation (10 Minutes)
- Videotape presentation (8 Minutes)
- Technology presentation (15 Minutes)
- Presentation of final Web sites (15 Minutes)
- Interactive Discussion (10 Minutes)

Summary

This session will focus on the restructuring of the elementary classroom as exhibited by a project in Austin Road Elementary School in Mahopac NY. The Project—"2025—A Virtual Fair of the Future" is a World Wide Web site developed over the school year by Fourth Grade students. The class worked in teams on this Project two full days a week.

The year-long experiment created a "digital workplace of the future" in their classroom. It was designed to allow student teams to work together to determine how the world will look in 2025 and particularly how technology will affect everyone's lives.

To achieve this, each team had to research a theme normally addressed during the school year: The themes were Transportation, Space Travel, Environment/Ocean Science, School and Community. Each project team consisted of 6 students. The final product was a report on the future exhibited by each group on the World Wide Web.

The project is a joint curriculum development project of Mahopac Central School District and The Lower Hudson Regional Information Center of The Southern Westchester Board of Cooperative Education Services (BOCES). The Regional Information Center created a World Wide Web Template for the project, so students could easily place their work on the Internet for all to see. This was accomplished via the World Wide Web forms capability. They also provided a Web server for placement of the Web Site.

The classroom was divided into Development Areas

- 2 Web and Graphic development stations—Networked Pentium Grade Multimedia Computers with software as described above Video Editing Station-Networked Pentium Grade Multimedia Computer with software as described above (Analog equipment such as LaserDisc and VCR attached)
- 2 Research, Writing Stations (Dell Laptops)—with word processing, networkable, Internet capable
- 2 Field Support Stations (Dell Laptops)—Used on outside expeditions for data gathering, and camera "digital dump"

Student Roles

- Producer
- Writer
- Graphic Artist
- Researcher
- Expeditionist

General Session: New Curriculum Designs/Instructional Strategies

Dithering Computer Art Skills Into the Curriculum

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Key Words: **dither, integration, elements, principles, draw, paint, commands**

Abstract

Dithering is an analogy I use to describe the integration of the concepts, vocabulary, and essential content of curricular subjects. In art, begin with the language of art... the elements and principles... and then compare/contrast the similarities and differences among these concepts and terms with other subject areas.

Commonly Asked Questions

#1. Which art application should I use?

Begin with any art application that provides basic drawing or painting tools but doesn't overwhelm your computer's memory—both RAM (Random Access Memory) and storage or

Hard Drive memory. Learn the tools and menus in the program well. Most art applications have similar icons, tools, and comparable menus. After learning one application, you will find you can master other applications more quickly. Programs that have huge memory requirements tend to be more complex and have a steep learning curve. Each application, however, has special nuances and unique tools for creating, manipulating, and integrating art work into other documents and projects.

#2. What is the difference between a Paint and a Draw program?

Paint programs simulate other creative art media such as: water colors, oils, air brush, or chalks. Working in a paint program is like sketching with a pencil or painting with a brush. You can create custom shapes, textures, gradients, and edit individual squares on the screen called pixels. Because images are created by dots or pixels, like filling in squares on graph paper, they are fuzzy and have jagged edges.

Draw programs, on the other hand, are based on mathematical formulas. Graphics and text are object-oriented. Working in a draw program is similar to cutting out shapes and making a collage. You can use a Draw program to create smooth, crisp graphics and to quickly select and move objects. While images are sharper, the major drawback of a draw program is the inability to edit or make small changes, pixel by pixel.

#3. Mouse or graphics tablet?

When students learn to draw on the computer, it is like learning to use a paint brush or pencil. They become adept at using either the mouse or graphics tablet. If students first learn to draw with a mouse; however, they need time to adjust to the stylus or drawing pen on the graphics tablet. Older students will find the pressure sensitivity of the stylus with art applications gives them better results and is more akin to drawing and sketching on paper, canvas, or other surfaces.

Beginning and Continuing Strategies

Time for students to explore and discover, reflect, and assess is just as important as sound instructional goals for each lesson. Students quickly acquire knowledge, skills, and techniques when they work on assignments both cooperatively with peers and also independently. Independence gives students time to explore and develop their own system for acquiring, analyzing, and synthesizing information. Russian psychologist, L. S. Vygotsky, uses the term—**zone of proximal development**—to describe the type of learning activity that establishes a relationship between the learning and development. In this zone, learning occurs when these conditions exist:

- Collaboration with peers
- Problem-solving with adult supervision
- Time for independent discovery

This kind of instruction is very powerful because it gives the student immediate ownership of the learning.

Initial Experiences

1. Whether or not a computer lab is available, have students work in small groups or with partners ... randomly paired or match novices with more experienced students ... fears dissolve more rapidly.
2. Design initial lessons to teach students basic computer skills:
    - Safely turning On and Off the computer.
    - Clicking and Dragging.
    - Opening and Closing Folders, Files, and Applications.

  - Using the Selection tools to Copy, Paste, Move, and Manipulate images and objects.
  - Using the "Save As" command to title, retitle, and save at different stages of the work in progress ... to a floppy disk or file on the server.
3. Plan open-ended assignments for introductory lessons. Choose one or two tools from the menu. Assign a simple task that uses these tools and menus but allows for exploration.
4. Choose tools or menus that augment previously introduced tools/menus for subsequent lessons as you continue to build computer art skills.
5. Use checklists and establish minimum requirements to guide students, provide independent problem solving, and allow them to monitor their own progress.
6. Focus on process as well as the product and always allow time for discovery and exploration. Remember:
   - There are multiple ways to accomplish most tasks on the computer, and students need to develop their own path.
   - Students learn and remember more when they make discoveries about tools and menus.
   - Mistakes and discovery are all a normal part of learning and should not be discouraged.
   - Learning is cumulative. Over time as students develop skills the products will improve.

Workshop

Tessellation Fascination

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Key Words: **tessellations, transformational geometry, symmetry, patterns, translation, rotation, glide reflection**

Abstract

Found in transformational geometry, tessellations are defined as patterns made from copies of a shape or shapes that fit together without gaps or overlaps. While these patterns can extend in any direction indefinitely, all of the tile shapes or patterns they create contain some kind of symmetry or balance.

In 1920 M. C. Escher (1898–1972), a Dutch artist and mathematician, was impressed by the Moorish mosaics he saw while traveling through Southern Spain. These geometric tiles inspired him to research tile shapes that could be altered to make recognizable organic shapes such as birds, animals, fish, or people. Through experimentation, Escher discovered three shapes—the equilateral square, triangle, and hexagon—could be transposed in either of three methods to make a tessellation. The three maneuvers are called: translations, rotations, or glide reflections.

- A translation begins with a shape cut from one side of the tile that slides to the opposite side. Two slide translations can occur on the same tile by using both the vertical and horizontal sides resulting in more interesting tile shapes.

- A rotation is made by taking the same cut shape and turning or rotating it around a point, clockwise. The consequent tile pieces is then rotated to complete the tessellation. The point of rotation can be at a corner or midpoint of a side.
- A glide reflection begins with the same cut shape and then encounters a slide and a flip or turn. Tiling similar pieces together involves the same maneuvers.

At the same time M. C. Escher was experimenting and discovering precise rules to create tessellations, Heinrich Heesch was working independently to devise a math formula to describe these attributes. Heesch's system is called, Heesch Type. He uses letters to describe the number of sides as well as the kind of tessellation and numbers following the letters to describe the moves as well as the degree of the angles.

For example:

T indicates a Translation or slide.

C indicates the Center of Rotation.

G—means Glide Reflection.

TTTT indicates a four-sided figure that uses Slide Translation to make a tessellating tile.

G1G2G1G2 represents a Glide Reflection made by moving the cut shape to the opposite sides of a four-sided figure. G1 matches or slides to the opposite G1. G2 matches G2.

G1G1G2G2 indicates another Glide Reflection but this time the cut shapes move to the adjacent rather than opposing sides.

While the letter C indicates the Rotation of a cut shape around a point or vertex, the number of C's indicate the number of sides of the original figure and the numbers following the letters indicate the degree of the angle.

C = 180°, C3 = 120°, C4 = 90°, and C6 = 60°

Students of all ages can develop problem solving, creative, and visual/spatial thinking skills found in both math and art by making tessellations. Begin with hands-on activities to help students grasp the concept of tessellations and then use computer applications to take the learning from abstract to concrete.

Workshop

A Computer Created Hands-On Activities for Math Centers and Basic Skills

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Key Words: **math, problem solving, centers, cooperative groups, basic skills**

Abstract

Traditionally, students have spent more than 75% of class time on computation and drill on skills in isolation from problem-solving situations, according to Marilyn Burns. Relevance for computation has been neglected, both in daily teaching methods and in student texts.

Learning through significant experience is considered to be long-term and therefore, more useful to students. A significant experience for an elementary student, as most teachers know, is one in which student interaction takes place. Discussion and defense of one's views are highly socially interactive experiences. All students want to have the right answer to the problem, and they want their peers to know how smart they are. Discussion of math problems makes them meaningful. Text book problems are by nature not conducive to social interactions. When everyone has a book, everyone does his/her own work without the benefit of others' input.

Putting word problems on a poster at a center creates an environment for interaction to occur. These problems can be taken from the students' texts, problem-solving teacher activity books, or created by the teacher. Done on the computer with added clip art or with programs such as Scholastic Super Print and Print Shop Deluxe makes them attractive and interesting. Students, clustered together to read the poster, form a social unit, allowing for natural self-organization of the group. Research shows that learning increases when students are jointly engaged in problem-solving (Cohen 1984; Cohen and Lotan 1989; Cohen, Lotan, and Leechor 1989). Students perceive their work to be a more real experience as the link between verbal interaction and learning is established. Discussion provides practice and knowledge reconstruction.

Many teachers are now realizing the necessity for teaching problem-solving strategies to their students but continue to hold fast to the belief that computation practice should remain an important part of the daily math program. Time and interest are significant factors in teaching. Traditional methods for learning basic math facts, flash cards, around the world game, oral repetition, and timed tests are either boring or involve few students at a time. Until these facts are learned, practice of other forms of computation are difficult. Therefore, the sooner these skills are learned the better. But how does a student remember something that has little meaning at the time of learning?

According to O'Keefe and Nadel (1978), one type of memory that involves storage in the brain is called taxon memory systems. These systems contain information that is memorized through practice and repetition but is not initially meaningful. Taxon learning is linked to extrinsic motivation and items learned are isolated. What is important is that this information can be accessed and used on demand.

Training Camp is an exciting fast-paced team approach to learning basic skills in math, spelling words, and simple facts in science and social studies. This cooperative/competitive game format provides a sensory situation in which practice occurs. Students practice the facts using oral, aural, and written methods. Frequent repetition of the game with its extrinsic motivation of teamwork and ensuing rewards for earned points transfers the knowledge to taxon memory systems for storage to be used when needed. Frequent repetition of basic facts and their use in meaningful problem-solving experiences transfers the facts to long-term memory.

Traditional Poster Session

Treasure In, Treasure Out—Getting Wee Webbers Connected

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Key Words: **e-mail, grants, writing, cross-generational, keypals, Internet**

Goodman Elementary, a K–6 school in Chandler, Arizona has an enrollment of 680 students who consistently snag some of the state's highest national testing scores. Goodman received one of only five 1995 A+ School Awards given by the state of Arizona and has been invited to apply for national Blue Ribbon status in 1996. Prioritizing technology has contributed to these honors.

Prior to 1994 Goodman's technology included a 32-station 386 PC-compatible computer lab with Jostens software, a library-based closed circuit TV distribution system with monitors in each classroom, an online library catalog, one LaserDisc, one Mac computer, and 30 Apple IIgs computer distributed to the classrooms. Since 1994, under the leadership of Principal Christine Walters, Goodman has been aggressively bringing newer, multimedia computers, and Internet to the school. Thirty-eight thousand dollars has been raised in two years.

In 1995 Goodman was awarded a $10,000 US West Technology Grant for The Goodman Gators Cross-Generational Correspondence Project created by the first grade team. The goal of this heart-warming project was to promote, refine, and improve written language skills for first grade students through an e-mail exchange of stories, tales, and cross-generational life experiences. Lifelong learning opportunities are promoted for the first grade students and the community senior citizens, many who are computer newbies, as they explore keyboarding, e-mail, word processing, graphics and create writing portfolios. The grant provided one multimedia Mac computer with a modem and a color printer for each of four classrooms. Students, teachers, parents and seniors began the e-mail skill-learning process and writing exchange. Culminating activities included the creation of cross-generational portfolios, extensive news coverage, and a reception for student, senior keypals, and an invited US West representative.

During the 1996/97 year, the project continues to prosper. Technical literacy is a priority for new first graders and for those who transitioned to second grade. The primary students are resources and teachers for upper elementary grade students. By spring quarter, every classroom at Goodman will have a multimedia Mac with a modem and a color printer. AlphaSmart Pro keyboards will be introduced during the 1997 and will facilitate all students being able to participate in the e-mail project. Keypals this year will expand to include parents participants in the home or workplace, relatives from other states and countries, and students across the K–6 grades will experience cross-generational writing. Seniors citizens are interested in including more of their Sun Lakes retirement community in the project. They wish to involve their computer clubs in the donation of computer systems to the schools when they upgrade. Definitely, a win-win community project.

This poster session will outline, step-by-step, the uphill and the downhill of getting the Goodman Wee Webbers connected to the Internet. The handout explains each part of the project, including the pros and cons of different types of Internet providers and ways that Goodman is providing inservicing and support for the multimedia computers. Christine Walters and Rikki Hayes will share student work demonstrating the progress in written language skills exhibited by the wee Webbers.

General Session: New Curriculum Designs/Instructional Strategies

Heritage OnLine: Online Professional Development Courses for Teachers... Exploring the Internet for Teaching and Learning

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Key Words: **online professional development, Heritage OnLine, distance learning, Web site listing, World Wide Web**

Purpose

Heritage OnLine (HOL) is a program of online, university credit courses for K–12 teachers which has two goals. First, we aim to meet the professional development needs of teachers in a wide variety of subject areas, such as social studies, math, science and language arts, and to provide opportunities to earn university credit. Second, we want to promote usage of the Internet among regular classroom teachers, and highlight the potential for the Internet as a teaching tool. This, we hope, will help encourage Internet usage for student learning.

In this article, I would like to provide an overview of key aspects to the program. This will hopefully benefit either those interested in using our courses for staff development or for those wanting to replicate a similar distance learning effort. Specifically, I will cover:

- The basic concept of Heritage OnLine
- The optimum candidate for a Heritage OnLine course
- Technical and course designs in the HOL model
- Our major learnings from 1996—our first year of operation
- Strengths and weaknesses of this kind of program

The Basic Concept of Heritage OnLine

Heritage OnLine (HOL) was initially conceived as a better learning alternative to the traditional "correspondence course." We thought that if our instructors and teachers could communicate and exchange written assignments by e-mail, we would achieve better learning than with the typical non-interactive distance course which has little feedback and no actual dialogue.

From that starting point, we asked many questions as our vision for a more technology-integrated program began to grow. Why not have assignments in which teachers would explore online resources as part of their learning? Why not create listservs, or e-mail discussion groups, for each course? Why not serve the course syllabus online in HTML with, in some cases, key portions in hypertext, so that the syllabus itself becomes a learning tool. Why not have online registration in a variety of forms?

And as we said "Yes" enthusiastically in answering these questions, the notion of truly blending Internet technology with distance learning for educators took shape. Herein we saw the chance not only for teachers to learn valuable content in math, science or language arts, but to also learn how to use Internet technology for themselves and for their teaching.

The Optimum Candidate for a Heritage OnLine Course

We serve a professional development need for the growing number of teachers who would rather study at home and on a flexible schedule vs. driving to a regular class, in some cases at great distances. Many of the teachers who choose our distance courses either live in rural locations, where classes for teachers are scarce, or they have young children at home making them less mobile. In addition, we have found a growing number of urban teachers who are simply tired of commuting on crowded metro-area highways, and who would prefer to work from home.

We discovered from past mistakes that we need to make sure teachers have enough Internet experience so that technology issues don't get in the way of their learning. In our 1995 test of HO, we had perhaps six registrants who were new to the Internet and one who was just getting her computer and modem out of their boxes. These unfortunate people had so many struggles with ISPs, getting modems set up etc. that they wound up having to drop their course. Now we require e-mail and, preferably, WWW experience and access from home or school or both, and the technical issues are much less of a problem.

Technical and Course Designs in the HOL Model

Course registrants work from a variety of PC or Mac platforms mostly from home, and are responsible their own ISP, e-mail and Web browsing software. Almost all of our registrants also have computers at their schools. In fact, the desire to learn more about the Internet and its uses in teaching was a main reason, besides course content, for taking their course.

HOL provides a Web site listing all courses, fees and our policies. From there participants can both read and download the course syllabus complete with assignments. We run a listserv program called ListSTAR which supports a listserv, or e-mail discussion, for each course in addition to a faculty list and a list which includes all registrants and instructors. Instructors are responsible for monitoring the list for their course, while the faculty and all courses list is the responsibility of the HOL director, which is me, Mike Seymour.

HOL faculty are geographically dispersed throughout the U.S., for the most part have K–12 teaching experience and all are knowledgeable in telecommunications.

Our course design features three parts:

1. Information Acquisition, where teachers do research, reading, interviews or other forms of information gathering, which is synthesized in a variety of written papers.
2. Learning Application, which we consider one of the more important parts of our course design, and which guides teachers in developing and actually teaching units and lessons from their learning in part 1.
3. Self-Reflection & Integration, in which teachers with student input assess their instructional efforts and reflect on their learning from the whole course.

We've found that it's important to serve teachers' needs for information which they can use in their teaching situation. Teachers are busy and are always looking for fresh new ideas to bring into their classrooms. Overly academic or theoretical courses tend not to be well received.

Our Major Learnings From 1996—Our First Year in Operation

As 1996 was our first year, we had surprises and both successes as well as disappointments. We learned a lot, such as:

Overall Evaluation—In late summer 1996, we sent out a survey to program participants. The overall results were very encouraging. Teachers in the program gave us the highest ratings on course content, the expertise and contribution of the instructors, and the appropriateness of the course assignments. We got lots of good reviews on the overall concept of Heritage OnLine, with many saying they feel this is a great way to learn how to use the Internet while exploring a content area of interest to them. A number of teachers taking an HOL course have gone on to be technology leaders in their schools, training other teachers on how to use the Internet. We were pleased to see that many had created and implemented successful Internet-assisted lessons with their students, which is unlikely to have happened without the incentive and framework provided by their HOL course.

Marketing & Enrollment—The enrollment relative to a fairly big direct mail marketing effort was lower than we had expected. To date, in 1996, we have enrolled about 90 teachers in one of 15 courses. Most teachers have come from the U.S., with several from Europe, Asia, and Canada.

We explored many avenues to post notices online, but were never very successful in finding a good way to market the program online. I have heard this complaint echoed by others as well. This leaves us with having to use direct mail as a marketing vehicle, which is quite expensive. Next year we are looking to fine-tune our direct mail marketing even further in order to increase efficiencies.

Optimum Timing—We were correct in our initial assessment that the best time to offer courses for teachers is in spring and summer. We have also found this to be true in our regional program of continuing education. Teachers are simply too busy to do a great deal of study during the school year, and summer is their time of choice to start their professional development courses.

Listserv Communication—As we had placed such emphasis on the benefit of group discussion via the listservs, we were surprised and disappointed by the relatively low level of listserv usage. A lot of programs that have used listprocs or listservs have had similar experience.

Among both instructors and registrants, I found that about 15% of the list participants would actually communicate, while the majority just "lurked." In our survey, we found that people tend to be shy about writing to an unknown audience. On the opposite side, many said they can learn just as much by reading messages vs. posting. I also think many people just do not want to take the time to write.

We were unprepared for the number, though small, of people who would be irritated by message volume from the listserv, and offered people the option of not being on the list if they didn't want to. There were about 3–4 people who asked to be taken off the main all courses list, consisting of all instructors and registrants.

What, to me, seemed like a very light load of messages turned out to be a lot to someone who does not read their e-mail daily like I do. In this way, I learned that many people who do not use the Internet frequently may only read their messages once a week, whereas I check my e-mail sometimes 3–5 times/day. So, I can see their irritation at getting 30–40 messages all at once.

We learned from this that the kind of independent learner who chooses a distance course wants feedback and contact but does not need or necessarily want a high degree of connectivity. Now that I think about it, it makes sense. People who take distance courses are self-starters, like to work on their own and need interaction less than the inter-relational learners who need to talk things out in order to feel like they are "getting it."

E-Mail Communication Between Instructor and Course Participants—I was pleasantly surprised that the e-mail communication teachers had with their instructor and others in their course was rated very well and fulfilled the need that the listservs had intended to meet. In looking to the listservs as the main communication vehicle, I had overlooked the very simple fact that the main communication would be between the instructor and the teacher/registrant, as it should be. I was also pleased to find out that most people answering the survey had e-mail contact with two or more others either in their own course or another HOL course.

Procrastination—A Frequent Problem—With total responsibility for their own work, many teachers tended to procrastinate getting started. In our program we give teachers one year to complete, in order to make it easier for them to find time to study around their teaching day. We found it was extremely important to add structure in the form of getting early commitments of when they would start their first assignment.

Instructor Skills—Our best instructors are ones who keep frequent contact with their students, and who reply at least within 24 hours to e-mail. We had one instructor who hardly ever answered her e-mail, and several students, obviously, were infuriated. Needless to say, she is no longer with us. I have coached instructors to do the following things:

- Share yourself personally and create a warm atmosphere.
- Show caring and concern.
- Answer all e-mail inquiries within 24 hours.
- Post informative sites and events on their course listserv.
- Create links between course participants by referring them to each other.
- Create links between course participants and others you know of who could be helpful.
- When reviewing written lessons, provide commentary within the student's document and return it too them. Teachers want feedback.
- Keep organized folders on your computer by student and assignment, so that you don't forget who has done what assignment.

Strengths and Weaknesses of This Kind of Program

One main strength of a distance program with online communication is, I believe, a more complete quality of learning than what is possible in most live instruction. We certainly are more effective when compared to the typical workshop format in which most continuing education for K–12 educators is provided. This is because teachers work over an extended period in which they apply their learning in their classrooms and then evaluate the results. As such, we are really providing a practicum opportunity, which most teachers have not had since they got out of their student teaching or mentoring relationship they may have had in their first year of teaching.

The extended learning period enables us to see a lot of growth. At least six HOL registrants who started with very few Internet skills completed knowing HTML, leading their students through Internet-based lessons and becoming Internet trainers in their school and district. Those results are quite remarkable when you consider that they came from the experience of one three credit course.

Of course, we can only take credit for providing the framework and opportunity for learning. These kind of great results only come from people who are organized, self-directed and dedicated. As much as we would like to have more motivated learners like this, unfortunately I think they are in a minority. Distance learning is not for everyone, and we do still get a higher share than we would like of teachers who put off doing their assignments and then rush through at the end of their year turning in marginal work. Teachers are busy, and I believe the world of continuing education for teachers has pampered many into looking for the easy credits. Also, some teachers are still dependent on external structure, and tend to flounder in the freedom of independent study.

We try to overcome this. What we've found is that as teachers have more good experiences with distance learning, they become sold on it as a way to pursue their professional development needs, and they get to learn how to get the most value from their learning.

Not only is distance learning good for some people and not others, I believe it is a better vehicle to learn skills or gain content knowledge than it is impart new theory, impact thinking or values. Higher level thinking and attitude changes are better facilitated by the kind of complex cognitive and emotional dynamics which come from in-person communication and sharing. So I do not believe that a distance format, by itself, would be the most effective way to promote new models or ways of thinking and believing among teachers.

Lastly, having communicated with our HOL instructors by e-mail for over a year, I can say that I truly do miss in-person contact, and was delighted when I had a chance to meet several of our online instructors in person. As warm as I believe I am through e-mail, cyberspace is still a cool medium, and personal contact adds a new level of motivation and commitment. Without the ability to meet people in person, I would suggest that an instructor have at least 1–2 phone calls with the teachers in their course. Phone contact helps to fill the void.

General Session: Technology Implementation/Educational Reform

Staff Development, Making It Work: Learning Styles

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Key Words: **staff development, inservice programs, teacher training, professional development**

Adults learn by doing, they want to be involved. Demonstration is usually inefficient. Practice and coaching are desirable.

Problems and examples must be realistic and relevant to them as adults. They want hands-on examples where they can practice and apply their new knowledge in typical, real-world situations.

Adults relate their learning very strongly to what they already know. They tend to have lower tolerance for ambiguity than children, so explicit attachment of new knowledge to their existing base is a paramount necessity.

Adults prefer informal learning environments, which are less likely to produce tension and anxiety.

Changes in pace and instructional method tend to keep interest of adult learners high. Adult learners have short attention spans.

Unless conditions of training absolutely require it, a grading system should be avoided. Checklists of criteria met in the course of training, for example, are less intimidating than assigned grades.

The instructor should frame his role as a facilitator rather than central source of knowledge and expertise. This guarantees that participants will find the trainer approachable, a precondition of communication between the learner and teacher.

Adults have an awareness of the value of their time. Training should be efficient and cost effective.

Adults need to know the "big picture" ... the "why" behind the ... "how to" ... the "part to whole" relationships... the sequence and flow of the course.

Knowles, M. (1973). *The Adult Learner. A Neglected Species* Gulf Publishing: Houston, TX.

Planning Steps for Staff Development

Define
Design
Create
Outline
Add
Produce
Tailor
Create
Rehearse Parts of the Planning Process
Opening
Introduction
Objectives
Expectations

Body

Experiences
Information
Concepts
Skills
Active involvement
Discussion
Transfer of knowledge

Conclusion

Idea generation
Reflections
Follow up
Evaluation

Why is a Good Closing Important??? A Conclusion

Highlights essential learning
Summarizes learning, central concepts and themes
Gives time for reflection and pulling together
Provides action planning
Generates follow up support opportunities
Elicits feedback
Provides positive feeling of closure

Elements of Exemplary Staff Development

Even if outside consultants are used for workshops, local staff is available for follow-up.

Following workshops, teachers have easy access to the same technology they were trained on.

Teachers are the primary trainers of teachers.

Training is tied directly to classroom/curriculum school/reform objectives.

A minimum of 25% of technology budget is set aside for staff development.

Learning to use technology is required, not voluntary.

Principals, superintendents and other administrators take technology staff development courses along with their teachers.

Time for technology staff development is integrated into teachers work schedules.

Siegel, J. "The State of Teacher Training." *Electronic Learning,* May/June, 1995. 43–53.

Effective Inservices

Inservice programs that place the teacher in an active role are more likely to accomplish their objective than those which place the teacher in a receptive role.

Programs that emphasize demonstration, supervised trials and feedback are more successful than those that present ideas or material to teachers without opportunities for practice.

Programs in which teachers share and provide assistance to each other are more likely to succeed that those that fail to encourage interaction during and after training.

Self-initiated and self-directed training activities are associated with successful accomplishment of program goals.

Joyce, B. & Showers, B. (1983). *Power of Staff Development Through Research in Training,* Association for Supervisors of Curriculum and Development.

Keys to Effective Teacher Technology Training

1. **Incentives and Support for Teacher Training**
    - Needs to come from building and district administrators and from the school board
    - Incentives include college credit, CDE credit, release time
    - Needs recognition for performance and increased use of technology in classrooms
2. **Teacher-Directed Training**
    - More effective than administrative directed programs
    - Teachers can relate personally to benefits of using technology in classrooms
    - Teachers develop an understanding of technology, then proficiency in using it and ultimately teach using it
3. **Adequate Access to Technology**
    - Training needs to be hands-on
    - Need time to experiment and learn
    - Need access at school and home
4. **Ongoing Support and Training Opportunities**
    - Formal as well as informal
    - Classes to expand, review and update knowledge
    - Opportunity to share information and knowledge

Nuts and Bolts of Effective Staff Development

- Types of Inservices
- Scheduling
- Typical class
- Handouts

Staff Developer Providers

- Training Session
- Check List

Traditional Poster Session

Project Greenskate: An Interactive Unit on Toxicology for Grades 7–12

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Key Words: **microworld, environment, toxicology, Internet, constructivism, health sciences, interactivity**

Description

Young learners appreciate the relevance of basic science to everyday life and decision-making as they explore the rich information landscape of *Project Greenskate* (CD-ROM).

Abstract

Project Greenskate embraces an open-ended approach to learning from computers. Following a constructivist learning paradigm, we are designing a microworld rich in information relevant to the discipline of toxicology. In the scenario central to the program, a group of high school students in the fictional city of Lakeview has spearheaded a grassroots movement to turn an abandoned piece of lakefront property into a park for rollerblading, skateboarding and concert-going. Local businesses have been enlisted to fund the project and proceeds from the park will be donated to various social organizations chosen each year by the student body as a whole. The plan has gotten lots of media attention for its innovative approach to education and as a paradigm of student involvement in community activities.

Unfortunately, as the user enters the story, the site has been found to be contaminated from previous industrial use. The user's task is to gather relevant information from various sources in the community in order to write an article about the situation for the school paper. As they travel through the landscape, they find and collect key documents that they will need to write their article. These appear as icons in their virtual backpack. Along the way, they learn the fundamentals of conducting a risk assessment and identify the many issues related to hazardous site management.

Although the embedded activity is an offline writing assignment, teacher support materials will provide a range of possible culminating activities and assessment criteria. The material is constructed in such as way as to lend itself equally to in-class debates, role plays, and short answer quizzes.

In addition, *Greenskate* also seeks to give students a manageable introduction to the Internet. Although the program will be presented on CD-ROM to guarantee easy dissemination and usability, the material is composed in HTML and will be accessed with a customized version of Netscape included on the disk. Eventually, updates and additions can then be supplied online. With its simplified browser interface and Web-based design, *Project Greenskate* permits the learner to gain an easy introduction to the Internet and online research, as well as to learn about the basic scientific and social issues that encompass hazardous waste problems. This program is intended for grades 7–12. (Release date: June 1997)

General Session: Society Session/K–16 Computer Science (Organized by SCS)

How to Make Your Programming Code Machine Independent

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Key Words: **dynamic migration, portability, machine independent software**

Dynamic migration has been investigated in several research efforts as a vehicle for load sharing, resource sharing, communication overhead reduction, failure robustness, and several other contexts. The talk presents a summary of related work in dynamic migration, and suggests motivations for considering heterogeneous migration. Next a design for heterogeneous migration, along with its restrictions is presented. A prototype implementation is described. Conclusions are drawn and future work is suggested.

Dynamic native-code heterogeneous process-originated migration is the physical movement of an executing process from one machine to an architecturally different machine, where its execution continues. The process runs as machine code on hardware on both machines, rather than by software interpretation. The decision to migrate such a process is made by the process itself (possibly in response to an external request) rather than by some external system. This requires cooperation between the application, the operating system, and the language system. From the perspective of the program requesting migration, the requested migration takes place during a call to a service routine. The destination machine or a class of destination machines is a parameter to this routine. When control returns from the service call, the program continues executing, now on the destination machine. For system-originated migration, one needs to allow either the process to progress to a point where it can be conveniently migrated or roll the process back to a point where it can be migrated.

With the growing popularity of computer workstations and the advent of high-performance networking, there has been much research into how to make better use of the resources available on a network. Much of this work falls under the umbrella of distributed computing. One aspect of distributed computing is process migration. A number of motivations for migration has been discussed in the literature: dynamic load balancing (to tune for response globally and dynamically), idle machine sharing (to increase overall utilization and make occasional use of a rarely available high-performance machine), fault tolerance (by moving processes from inoperable workstations to operable workstations), an alternative to remote access (potentially more flexible), reduction of response latency (by eliminating some communication steps), continuous running of long-duration (month or year) software in the face of machine maintenance, wider use of special architectural capabilities of particular machines (such as vector processors and floating-point accelerators), and flexibility in upgrading and expansion.

Most efforts approach heterogeneous migration by suspending the program, obtaining a copy of the state, transforming the state to the destination machine, and resuming execution. State transformation is by far the most complicated operation within the migration facility. The state of the process is distributed in its address space, the environment provided by the operating system, and in CPU registers. It requires some work to gather this state from the source machine. Furthermore, since the destination machine may be of a different architecture, it may not be obvious how to reincarnate this state on the destination machine.

Migration is similar to, though more flexible than, remote procedure calls. The body of work done in that area has solved many of the thornier representation issues, and the widespread use of cross architectural procedure calls demonstrates that a diversity of floating-point representation schemes is at worst a minor inconvenience. Moreover, dealing with differing floating-point representations is an issue for the application software, not the migration system. Clearly with either remote procedures or migration in heterogeneous environments there is the potential for precision loss due to different floating-point representations. In general, the amount of precision loss is not deterministic (it depends on what migrations occur or which server provides the service). However, the loss is bounded by the precision of the least precise machine.

Several researchers approach migration or remote execution with a machine-independent intermediate language but these approaches will, by nature, pay a significant performance penalty.

A language system produces an executable file that is eventually loaded as part of a process with an appropriate operating system environment and an address space. The process progresses as the CPU executes instructions within the address space of the process. While doing this, the CPU uses its registers extensively for computation and to hold intermediate results. When a point of migration is reached, the migration facility is started.

The language system is involved in the migration to the extent of simultaneously generating native-code for multiple target machines in a way that allows migration. It also is responsible for providing correspondence information needed during migration. It communicates the multiple sets of native-code, initialized data, and correspondence information by embedding them in the executable file.

The migration facility uses the correspondence information, the native-code for the destination machine, and a knowledge about how the native-code was generated to transfer the process' state between machines. So that later migrations are possible, the migration facility must carry along the correspondence information and the native-code for other architectures.

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General Session: Current/Emerging Technologies

The Digital Learning Environment: Wisdom Tools for the Internet

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Key Words: **tools, problem solving, learning, Internet tools, Web-based tools, knowledge tools, digital learning**

Mission

The mission of Wisdom Tools, our research and development group at the Center for Excellence in Education at Indiana University:

- To replace the linear, content-centered classroom with a new kind of learning environment. This environment will change the way instructors teach, students learn, and the way content is delivered.
- To define this new Digital Learning Environment, develop the software tools to produce it, partner with others to design innovative learning products for use in it, and advise organizations on how to create it.
- To distribute its products and services to K–12 and higher education institutions.

Digital Learning Environment

An underlying assumption of traditional K–12 and undergraduate education is that mastery of content presented by instructors or included in textbooks will result in the ability to solve diverse problems of the everyday world. We now know that this assumption is largely false.

Even the most able student finds it difficult to make appropriate connections between what they learn in the classroom and understanding the nature of problems and their solutions outside of the classroom. These real-world or everyday problems are different from the well-structured, single-solution textbook problems students solve in the classroom (Sternberg, 1985; Siegel and Kirkley, 1996):

Characteristics of Real-World Problems	Characteristics of Classroom Problems
In the everyday world, the first and sometimes most difficult step in problem solving is recognition that a problem exists	The instructor or textbook signals that a problem exists
In everyday problem solving, it is often harder to figure out just what the problem is than to figure out how to solve it	The instructor or textbook provides the problem
Everyday problems tend to be ill-structured	The instructor or textbook defines the problem
In everyday problem solving, it is not usually clear just what information will be needed to solve a given problem, nor is it always clear where the information can be found	Needed information to solve classroom or text-based problems is found in the associated chapter or lecture; often parallel problems (examples) are solved for the student
The solutions to everyday problems depend on and interact with the contexts in which the problems occur	Classroom or text-based problems are self-contained; little or no context is provided
Everyday problems generally have no one right solution, and even the criteria for what constitutes a best solution are often not clear	Classroom or textbook-based problems have one right solution; textbook solutions are found in the back of the book
Solutions to important everyday problems have consequences that matter	Solutions to classroom or textbook-based problems have no consequences other than a grade
Everyday problem solving often occurs in groups	Classroom or textbook-based problem solving often occurs alone
Everyday problems can be complicated, messy, and stubbornly persistent	Classroom or textbook-based problems are clear, well-defined, and easily forgotten

A new paradigm, consistent with emerging models of Web-based instruction, is required to change the focus from content-centered to problem-centered learning. This paradigm—the Digital Learning Environment—incorporates the following features:

- a learner-centered and problem-based (rather than content-centered) instructional support system, in which learning is based upon analysis of a series of complex, real-world issues rather than upon memorization of facts and principles
- safe settings for learning, in which making mistakes becomes as powerful a learning tool as employing successful problem-solving strategies in real-world contexts
- a blurring of instructor and student roles, such that instructors model and demonstrate learning in problem-based settings, while students facilitate and manage their own learning environments
- access to an integrated package of navigational, productivity, communication, collaboration, and knowledge/wisdom creation tools
- management tools that facilitate the development of student goals and activities as a collaboration between students, instructors, (and parents), of which key components are alternative and traditional assessment practices
- independence of any particular hardware or delivery system configuration

- an open, ever-changing, and ever-expanding information architecture, which has access to a global information network like the Internet (or the company's Intranet), in contrast to a closed information architecture (e.g., book, diskette, videodisc, or a CD-ROM), which is finite and frozen in time

Taken together, these features are designed to facilitate big concept, multi-disciplinary learning, and the development of authentic, cooperative problem-solving strategies. Moreover, changes in instructor and student behavior are promoted by direct training and collaboration embedded in tools that foster self-awareness and the development of a community of learners; each person—instructor and student—becomes a coach and a learner.

In K–12 schools and universities, the best teachers and professors are moving away from textbook-based and lecture-centered instruction. Nevertheless, most lack the tools and "know-how" for creating effective Digital Learning Environments that exploit the strengths of the new media and deliver instruction to students distributed nationally and globally.

TimeWeb™

Our first Internet-based tool—TimeWeb™—is designed to help users view information from the perspective of time, to understand (and speculate about) connections among events, and to understand the nature of information and how it is categorized.

For example, imagine a history course with access to the TimeWeb tool. Instead of viewing information in the usual hypermedia format or more traditionally in a textbook, the same information is plotted on a two-dimensional grid. Categories such as science, history, literature, art and music (and their hierarchical subcategories) are plotted on the vertical-axis, and time (in decades, years, months, etc.) is plotted on the horizontal-axis. Not only can students navigate through this timeline, comparing information found in one category with another, but they also can construct their own timelines — deciding where a given event "belongs." Web sites, individual pages, local files, graphics, animations, and sounds are represented as icons on the two-dimensional time grid; clicking on an icon opens the Netscape viewer, taking the student directly to that information (or URL address). By manipulating the time scale and viewing time from varied resolutions (say, zooming into days or moving out to millennia) — or by opening and closing categories and subcategories, students gain additional insights by noting changing patterns and relationships.

(TimeWeb will be demonstrated during the session. An example of teaching African prehistory and the archaeological record will be used. This work, "Prehistoric Puzzles," is funded in part by a grant from the National Endowment for the Humanities.)

> *We all live on the great, dynamic web of change. It links us to one another and, in some ways, to everything in the past. And in the way that each of us influences the course of events, it also links us to the future we are all busy making, every second.... Each one of us has an effect, somewhere, somewhen (Burke, 1996).*

Traditional Poster Session

Connecting Schools and the World of Work

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Key Words: **videoconferencing, distance learning, ISDN, school to work, career education**

Many schools and communities are building school to work systems so that all students, all learners, experience a comprehensive career education and development process during their time in learning institutions. School to Work links activities in the school with partners outside of the school so that career education experiences are intimately connected to the world of work and the specific facets of career and job skills.

This presentation highlights the projects on Long Island that have used both low and high band videoconferencing technologies to bring teachers and students together with industry partners without the inconvenience of leaving the school building or workplace. Specific activities were designed to maximize the use of technologies; provide access to a variety of economic profile districts; include diverse businesses and career areas; and meet learning standards for students.

Several schools began the project with fiberoptic classrooms already in place for traditional high school instruction. Other schools established videoconferencing capabilities using PC's, ISDN phone lines and modems, and software such as Intel's Proshare that are often placed on portable carts so that many classrooms with ISDN jacks can participate. The costs and process of establishing either of these systems will be presented along with the staff development that was developed by New York State Teacher Centers, New York Institute of Technology, and the Nassau County School To Career Partnership.

The bridging of several sites (up to eight)and fiber with ISDN or POTS systems is provided by NYIT Technology Based Learning Systems Department. Pilot projects, curriculum, and activities were developed by teachers, partners from business and industry, NYIT, Teacher Centers, and the school to work partnership that would meet specific learning standards outlined by the New York State Education Department and by NYS School To Work.

Methods to recruit business and organizational partners will be defined. In this case, the technology did not present significant barriers since many companies, museums, hospitals, colleges, etc. have videoconferencing already. The challenge is to engage partners in the process of working with teachers and students to achieve educational outcomes, a common challenge in many school to work projects. Indeed, the technology of distance learning assisted any businesses in their ability and capacity to get involved with schools rather than reject the idea. The use of the Internet becomes critical as well to supplement and enrich the videoconferencing aspects of the curriculum and learning experiences.

Traditional Poster Session

The Internet Works in Mysterious Ways

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Key Words: **Internet, collaborative learning, research**

Abstract

A panel of teachers will share how they use the Internet in the classroom. Some of the completed projects will be shown.

Description

Last year many hours of Internet training were given to the teachers in the Las Cruces Public Schools with the help from a USWEST grant. As the year progressed these USWEST participants became aware of the **value of the Internet in the classroom.** By the end of the year many students were taught to use the Internet for research and other classroom projects from these teachers.

A panel of the USWEST participants; Margie Sharp, a pioneer in technology for the District and middle school teacher; Susan C. Smith, a technology coordinator and chairwoman of TSG and high school teacher; Richard Melendez, TMT member and high school principal; and Dr. Karin Wiburg, a published author on technology from New Mexico State University, will lead a discussion in **how to use the Internet in the classroom**. They will share their ideas and ways in which they have successfully used the Internet. With the help of the computer, they will show some of the classroom projects which have evolved from using the Internet. One example will be the ghost unit as described below.

Last year a ninth grade English class studied ghost stories in the area with the help of telecommunications and hypermedia. The class took a tour of areas where ghost were to have been present, took digital pictures, video footage, and interviewed local people. After researching the Internet, they were ready to put all the information together in order to make presentations. The class was divided into four groups, with each member taking on a specific role. One group wrote a book, another group made a video, one group created a Web page, and another created a HyperStudio program. The Web page for this project is

http://tesuque.cs.sandia.gov/~bbooth/OldMesilla/ghost/titlepage.html

The book, Web page, and HyperStudio will be shown as well as many other examples of what students have done with the Internet.

Other sites that will be shared:

Oñate High School Homepage—
http://tesuque.cs.sandia.gov/~bbooth/onate.html

Ghost Project Web Site—
http://tesuque.cs.sandia.gov/~bbooth/OldMesilla/ghost/titlepage.html

US*WEST* Las Cruces Web site—NUESTRA TIERRA SITE-

www.cahe.nmsu.edu/uswest

Young American Indian Students Program

There is no better way to learn than from each other, and that is what this session will be all about.

Spotlight Session

Technology for Teachers Who Love to Teach

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Key Words: **quality teaching, educational software**

Every teacher has his/her own teaching style that reflects unique goals and creative ways of how best to achieve those goals. The same holds true for how teachers incorporate technology into their classrooms. Too often buzz words confuse things by categorizing teaching methods and limiting the way teachers can think about technology. The most successful and gratifying teaching will take place when teachers can break free from the jargon that constricts them and learn that it's all right to follow their instincts.

Great teaching takes many forms, from inspiring individual self-discovery in the library or lab to managing dynamic cooperative groups in the classroom. Technology's role in the schools should be to foster all these forms of great teaching, improving learning among students by nurturing and supporting teachers.

Tom Snyder is CEO of Tom Snyder Productions, a leading publisher of educational software and CD-ROM. The company's products are designed for grades K–12 and promote discussion, problem-solving, reading, writing, and interdependence.

Tom Snyder Productions is dedicated to the principle that teachers are the primary catalyst for learning and inspiration in the classroom. As a result, teachers are put in the center of the computer-based learning environment, instead of on the sidelines.

General Session: New Organizational Structures

The Well Connected Educator: Writing and Talking Online

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Key Words: **writing, teachers as researchers, professional development, online forum, Web reviews**

Body of Entry

Are you a Well Connected Educator? If you use technology in your classroom or are concerned with educational technology as a tech coordinator, administrator, parent, teacher educator, or other member of the education community, you are!

The Well-Connected Educator is a place on the Internet (http://www.gsh.org/wce) for publishing teachers' and others in the education community's great ideas, models, and information about the use of technology for teaching and learning. Articles highlight successes, give strategies, discuss pitfalls, and present needed information and points of view.

It's also a place to debate hot issues in educational technology. Confront such topics as copyright, intellectual property rights, inappropriate materials, and misinformation on the Internet. What do you think? Do you want to state your point of view?

Even more, it's a place for educators to decide what their favorite Web site is and to tell why. Influence your peers with your hottest picks for professional development and student use.

Find out how to write for The Well Connected Educator, search for information, join a forum, post your hottest site, and become part of this online community. Begin by attending this interactive session and sharing your story, advice, or point of view. And meet the people who will help you make it happen. Then sign the guest book, pick a topic and become the latest Well Connected Educator.

Stephen Marcus will describe how writing coaches from the National Writing Project guide authors through the process. Anita Best will describe the editorial board's review process. Bonnie Price will show how expert moderators steer online conversations. Marianne Handler will explain how to tell a great Web site from the rest. Authors, coaches, moderators, Web reviewers, and you will provide hints about success. And Gwen Solomon will invite you to join the ranks of Well Connected Educators.

At The Well Connected Educator, you'll find:

Articles, Columns, and Special Features

Teachers, administrators, parents, and community partners write the articles, columns, features, and provide links to resources. All articles and materials are archived and are searchable on a variety of categories. Articles include "The Great Penny Toss," a mathematical probability project from New York City and "Hyakutake and the North High Comet Kids," an astronomical adventure in Salem, Oregon. Columns include "Research Reports," lessons learned from studying issues in educational technology and "Net News," current information on a variety of topics. Special features include listings of Internet resources on such topics as Special Education, Native Americans, and Internet field trips.

Forums

Do you want to talk about a "hot topic" in educational technology? Are you interested in what others think about the issue? Join our monthly online forums and have your say. Forums include "Law and Ethics on the Information Superhighway," "Revolution or Evolution: What has to change for technology to be well used in the classroom?" "Professional Development," and "The Deceiving Web of Online Advertising."

Teachers' Choice asks for your favorite Web site and lets you ask for recommendations by your peers. You'll let us know what's good for the classroom or for professional development and how you've used it. You'll find out what others think too.

Tell Your Story

Have you ever considered writing about your experiences? Think about writing for the Web, where your words can be read by others involved with educational technology around the world. Think about being able to include student examples or link to your favorite sites. Think about knowing that you're helping and even inspiring others.

The Well Connected Educator is funded by a grant from the National Science Foundation. Technical support is provided by Microsoft, Inc. and the Glob al SchoolNet Foundation. Other sponsors are Compaq and Advanced Networks and Systems. Collaborators are ISTE and the National Writing Project.

General Session: New Curriculum Designs/Instructional Strategies

Integrating the Internet and Curriculum: A Web-Based Course for Teachers

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Key Words: **Internet, curriculum integration, distance education, teacher training**

Introduction

Recent developments in conferencing tools, such as Speak Freely, Cool Talk, and Internet Phone, have created the potential for developing the social interaction and sense of connection that has traditionally been missing from distance education. These tools allow students and instructors to see each other, hear each other voices, and exchange hand written materials through the use of white-board capabilities, all in real-time. This paper explains how one conferencing tool (Speak Freely) was coupled with Web-based instruction and videos as a means of teaching a distance education course.

Internet Literacy for Teachers

A recent survey conducted by the United States Congress, Office of Technology Assessment states that teachers reported they mostly use telecommunications to send e-mail messages to colleagues (76%) and to access bulletin boards (62%). Only 44% of the teachers reported using the Internet to download curriculum and only 39% indicated they access online libraries (US Congress, 1995). What such statistics tell us is that providing teachers with connectivity and technology skills that enable them to get online is not enough. Teachers need to be taught how to integrate telecommunications into the curriculum.

Since the Fall of 1995, George Mason University (GMU) has been developing, implementing, evaluating, and revising a distance education course for teachers in the Department of Defense Dependents' Schools (DoDDS). The course was developed through funding provided by the DARPA Computer Assisted Education and Training Initiative (CAETI).

Taming the Electronic Frontier for Teachers was pioneered in Fall 1995 and repeated in Spring 1996 through a partnership between the Science and Technology Department and the Program on Social and Organizational Learning. The course was received enthusiastically by DoDDS teachers in Hanau, Wuerzburg, and Kaiserslautern, Germany. The course included e-mail and

Web-based interactions between the DoDDS teachers and GMU faculty, as well as, videotape lectures and demonstrations.

During the Fall of 1996 the third and final CAETI offering of this course was made available to DoDDS teachers in Kaiserslautern, Germany and Aviano, Italy. Through the assistance of the Graduate School of Education (GSE) at GMU, the final offering of the course (now called Internet Literacy for Teachers) included new material on integrating the Internet within the K–12 curriculum. The course consisted of short lectures and demonstrations on videotapes, synchronous communication with the instructors via audio conferencing and simultaneous "Web" interaction, and discussions with other educators via e-mail and listservs on a weekly basis. As the teachers learned about the tools of the Internet, they simultaneously learned how to integrate these tools into their curriculum.

Course Structure

The Internet Literacy for Teachers course was a combination of two separate courses taught simultaneously. Internet Literacy was a 1 credit hour course offered through the Program on Social and Organizational Learning. This course provided the vocabulary, concepts, skills, and software to read, search, and write hypertext for the Web and to participate in e-mail and discussion groups. This section of the course was taught through video tapes and Web-based discussions. Students were given a series of tasks to complete and submit via the Web. These tasks can be accessed at http://rembrandt.erols.com/96c.

The other section of the course was offered through GSE and focused on integrating the Internet in the curriculum. For this section, a series of synchronous sessions were set-up throughout the course. Slides were placed on the Web and Web-sites were identified that teachers could access during the discussions. These synchronous sessions were an opportunity for the teachers to ask questions, express their concerns about the course, and engage in a dialogue on the advantages and disadvantages of distance education. By using a conferencing tool called Speak Freely (available at http://www.fourmilab.ch/speakfree/windows), the instructor and students were able to carry on discussions in real-time. Speak Freely, a public domain program that runs with Windows, is equivalent to carrying on a telephone call between multiple people at multiple sites. A three-way conference was thus carried out between the teachers at Kaiserslautern, the teachers at Aviano, and the instructor at GMU in Virginia.

Speak Freely also provided the teachers the opportunity to share the Web pages they created for their final project which was to create a unit plan that they could teach in their classrooms. They were required to use the Internet as part of the unit and had to identify appropriate Web sites. Their final unit plans were turned into Web pages (course schedule, syllabus, materials and final unit plans can be accessed at http://nac.gmu.edu/inet-lit/index.html).

Evaluation

Feedback from the teachers indicated they were satisfied with the course as it was taught during the Fall of 1996. Although they admitted it was difficult, they also felt they learned a lot. Their comments can be accessed from either courses' Web sites.

References

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Paper Session

Computationally-Rich Activities for the Construction of Mathematical Knowledge—No Squares Allowed

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Key Words: **mathematics, Logo, contemporary math topics, NCTM, Euclidian geometry, number theory, chaos theory**

Abstract

The NCTM Standards state that *50% of all mathematics has been invented since World War II* (National Council of Teachers of Mathematics, 1989). Few if any of these branches of mathematical inquiry have found their way into the K–12 curriculum. This is most unfortunate since topics such as number theory, chaos, topology, cellular automata and fractal geometry may appeal to students unsuccessful in traditional math classes. These new mathematical topics tend to be more contextual, visual, playful and fascinating than adding columns of numbers or factoring quadratic equations. Logo provides a powerful medium for rich mathematical explorations and problem solving while providing a context in which students may fall in love with the beauty of mathematics. The examples in this paper are intended to spark the imaginations of teachers and explore several mathematical areas ripe for Logo-based investigations.

Introduction

While it may seem obvious to assert that computers are powerful computational devices, their impact on K–12 mathematics education has been minimal (Suydam, 1990). More than a decade after microcomputers began entering schools, 84% of American tenth graders said they never used a computer in math class (National Center for Educational Statistics, 1984). Computers provide a vehicle for "messing about" with mathematics in unprecedented learner-centered ways. "Whole language" is possible because we live in a world surrounded by words we can manipulate, analyze and combine in infinite ways. The same constructionist spirit is possible with "whole math" because of the computer. In rich Logo projects the computer becomes an object to think with—a partner in one's thinking that mediates an ongoing conversation with self.

Many educators equate Logo with old-fashioned turtle graphics or suggest that Logo is for the youngest of children. Neither of these beliefs is true. Although traditional turtle graphics continues to be a rich laboratory in which students construct geometric knowledge, Logo is flexible enough to explore the entire mathematical spectrum. Logo continues to satisfy the claim that it has no threshold and no ceiling (Harvey, 1982). Best of all, Logo provides a context in which children are motivated to solve problems and express themselves.

The National Council of Teachers of Mathematics Curriculum and Evaluation Standards for School Mathematics recognizes Logo as a software environment that can assist schools in meeting the goals for the improvement of mathematics education. In fact, Logo is the only computer software specifically named in the document.

The Goals of the NCTM (1984) Standards for All Students

learn to value mathematics

become confident in their ability to do mathematics

become mathematical problem solvers

learn to communicate mathematically

learn to reason mathematically

> *Computer microworlds such as Logo turtle graphics and the topics of constructions and loci provide opportunities for a great deal of student involvement. In particular, the first two contexts serve as excellent vehicles for students to develop, compare and apply algorithms (National Council of Teachers of Mathematics, 1989, p. 159).*

The examples in this paper are intended to spark the imaginations of teachers and explore several mathematical areas ripe for Logo-based investigations. The project ideas use MicroWorlds, the latest generation of Logo software designed by Seymour Papert and Logo Computer Systems, Inc. MicroWorlds extends the Logo programming environment through the addition of an improved user interface, multiple turtles, buttons, text boxes, paint tools, multimedia objects, sliders and parallelism.

Parallelism allows the computer to perform more than one function at a time. Most computer-users have never experienced parallelism or the emergent problem solving strategies it affords. MicroWorlds makes this powerful computer science concept concrete and usable by five-year-olds. The parallelism of MicroWorlds makes it possible to explore some mathematical and scientific phenomena for the first time. Parallelism also allows more conventional problems to be approached in new ways.

Euclidian Geometry

One source of inspiration for student Logo projects is commercial software. Progressive math educators have found software like *The Geometric Supposer* and the more robust *Geometers' Sketchpad* to be useful tools for exploring Euclidian geometry and performing geometric constructions. I noticed that while teachers may use these tools as extremely flexible blackboards, kids can pull down a menu and request a perpendicular bisector to be drawn without any deeper understanding than if the problem was solved with pencil and paper.

Could middle or high school students design collaboratively their own such tools? If so, they would gain a more intimate understanding of the related math concepts because of the need to "teach" the computer to perform constructions and measurements. Throughout this process, teams of students are asked to brainstorm questions, share what they know and define paths for further inquiry. Students as young as seventh grade have developed their own geometry toolkits in MicroWorlds.

Much of learning mathematics involves naming actions and relationships. Logo programming enhances the construction of mathematical knowledge through the process of defining and debugging Logo procedures. The personal geometry toolkits designed by students are used to construct geometric knowledge and questions worthy of further investigation. As understanding emerges the tool can be enhanced in order to investigate more advanced problems.

At the beginning of this project students are given a few tool procedures to start with. These procedures are designed to:

drop a point on the screen (each point is a turtle and in MicroWorlds every turtle knows where it is in space)

compute the distance between two points

With these two sets of tool procedures students can create tools necessary for generating geometric constructions, measuring constructions and comparing figures. MicroWorlds' paint tools may be used to color-in figures and to draw freehand shapes. The procedural nature of

Logo allows for higher level functions to be built upon previous procedures. Figures 1a, 1b, and 1c are screen shots of one student's geometry toolkit.

Probability and Chance

Children use MicroWorlds to explore probability via traditional data collection problems involving coin or dice tosses and in projects of their own design. Logo's easy to use RANDOM function appears in the video games, races, board games and sound effects of many students.

Perhaps the best use of probability I have encountered in a MicroWorlds project is in a project I like to call, "Sim-Middle Ages." In this project a student satisfied the requirements for the unit on medieval life in a quite imaginative fashion. Her project allows the user to specify the number of plots of land, number of seeds to plant and the number of mouths to feed. MicroWorlds then randomly determines the amount of plague, pestilence, rainfall and rate of taxation to be encountered by the farmer.

On the next page there are two buttons. One button announces if you live or die in the middle ages and the other tells why, based on the user-determined and random variables. You may then go back and adjust any of the values in an attempt to survive (figures 2a, 2b, and 2c).

Things happen in the commercial simulations, but users often don't understand the causality. In student-created simulations, students use mathematics in a very powerful way. They develop their own algorithms to model historical or scientific phenomena. This type of project can connect mathematics with history, economics, physical science, and life science in very powerful ways.

Number Theory

"Number theory, at one time considered the purest of pure mathematics is simply the study of whole numbers, including prime numbers. This abstract field, once a playground for a few mathematicians fascinated by the curious properties of numbers, now has considerable practical value... in fields like cryptography"(Peterson, 1988). Software environments, such as MicroWorlds, provide a concrete environment in which students may experiment with number theory. "Experimental math" projects benefit from Logo's ability to control experiments, easily adjust a variable and collect data. Kids control all of the variables in an experiment and can swim around in the beaker with the molecules. Intellectual immersion in large pools of numbers is possible due to computer access. The scientific method comes alive through mathematical experimentation.

A fascinating experimental math problem to explore with students is known as the 3N problem. The problem is also known by several other names, including: Ulam's conjecture, the Hailstone problem, the Syracuse problem, Kakutani's problem, Hasse's algorithm, and the Collatz problem. The 3N problem has a simple set of rules. Put a number in a "machine" (Logo procedure) and if it is even, cut in half—if it is odd, multiply it by 3 and add 1. Then put the new value back through the machine. For example, 5 becomes 16, 16 becomes 8, becomes 4, 4 becomes 2, 2 becomes 1, and 1 becomes 4. Mathematicians have observed that any number placed into the machine will eventually be reduced to a repeating pattern of 4...2...1....

While this is an interesting pattern, what can children explore? Well, it seems that some numbers take a long time to get to 4...2...1.... I call each of the numbers that appear before 4, a "generation." I often expose students to this problem by trying a few starting numbers and leading a discussion. Typing SHOW 3N 1 takes 1 generation to get to 4. Students may then predict that the number 2 will take two generations and they would be correct. They may then hypothesize that the number entered will equal the number of generations required to get to 4. However, 3N 3 takes 5 generations! I then ask, "how can we modify our hypothesis to save face or make it look like we were at least partially right?" Kids then suggest that the higher the number tried, the longer it will take to get to 4...2...1.... They may even construct tables of the previous data and make numerous predictions for how the number 4 will behave only to find that 4 takes zero generations (for obvious reason that it *is* 4).

I then tell the class that they should find a number that takes a long time to get to 4...2...1.... I do not specify what I mean by a "long time" in order to let the young mathematicians agree on their own limits. The notion of limits is a powerful mathematical concept which helps focus inquiry and provides the building blocks of calculus. Students often test huge numbers before realizing that they need to be more deliberate in their experimentation. The working definition of "long time" changes as the experiment continues. Eleven generations may seem like a long time until a group of kids test the number 27. Gasps and a chorus of wows can be heard when 27 takes 109 generations. Then I ask the class to tell me some of the characteristics of 27. Students often list some of the following hypotheses:

Its factors are 1, 3, 9, 27

It's odd

*It's 3 * 3 * 3 (an opportunity to introduce the concept of cubed numbers)*

The sum of the digits = 9

The number is greater than 25

We then test each of the hypotheses and discard most of them. The cubed number hypothesis is worthy of further investigation. If we test the next cubed number, 4, with SHOW 3N 4 * 4 * 4 we find that it does not take long to get to 4. One student may suggest that only odd perfect cubes take a long time. I then suggest that the other students find a way to disprove this hypothesis by finding either an odd perfect cube that doesn't take a long time or an even cube that does. Both exist.

```
to 3n :number
print :number
ifelse even? :number [3n :number / 2] [3n (:number * 3) + 1]
end

to even? :number
output 0 = remainder :number 2
end
```

A simple tool procedure may be added to count the number of generations for the "researcher." The more you play with this problem, the more questions emerge. A bit more programming allows you to ask the computer to graph the experimental data or keep track of numbers that take longer than X generations to reach 4...2...1.... Running such experiments overnight may lead to other interesting discoveries, like the numbers 54 and 55 each take 110 generations. What can adjacent numbers have in common? 108, 109 and 110 each take 111 generations. Could this pattern have something to do with place value? How could you find out? (see figures 4a and 4b)

The joy in this problem for kids and mathematicians is connected to the sense that every time you think you know something, it may be disproven. This playfulness can motivate students to view mathematics as a living discipline, not as columns of numbers on a worksheet. For many students, problems like 3N provide a first opportunity to think about the behavior of numbers. "For the most part, school math and science becomes the acquisition of facts that have been found by people who call themselves scientists" (Goldenberg, 1993). Logo and experimental math provides another opportunity to provide children with authentic mathematical experiences.

Fractal Geometry and Chaos Theory

The contemporary fields of fractal geometry and chaos theory are the result of modern computation. Many learners find the visual nature of fractal geometry and the unpredictability of chaos fascinating. Logo's turtle graphics and recursion make fractal explorations possible. The randomness, procedural nature and parallelism of MicroWorlds brings chaos theory within the reach of students.

Fractals are self-similar shapes with finite area and infinite perimeter. Fractals contain structures nested within one another with each smaller structure a miniature version of the larger form. Many natural forms can be represented as fractions, including ferns, mountains and coastlines.

Chaos theory suggests that systems governed by physical laws can undergo transitions to a highly irregular form of behavior. Although chaotic behavior appears random, it is governed by strict mathematical conditions. Chaos theory causes us to reexamine many of the ways in which we understand the world and predict natural phenomena. Two simple principles can be used to describe Chaos theory:

> From order (a predictable set of rules), chaos emerges.
>
> From a random set of rules, order emerges.

MicroWorlds may be used to explore both chaos and fractal geometry simultaneously. Figure 3 shows two similar fractals called the Sierpinski Gasket. The fractal on the left is created by a complex recursive procedure. The fractal on the right is generated by a seemingly random algorithm discovered by Michael Barnsley of Georgia Institute of Technology. The Barnsley Fractal is created by placing three dots on the screen and then randomly choosing one of three points, going half way towards it and putting another dot. This process is repeated infinitely and a Sierpinski Gasket emerges. In fact, if you grab the turtle from the "chaos fractal" and move it somewhere else on the screen, it immediately finds its way back into the "triangle" and never leaves again. The multiple turtles and parallelism of MicroWorlds makes it possible to explore the two different ways of generating a similar fractal simultaneously. Experimental changes can always be made to the procedures and the results may be immediately observed.

Animation

One of the most attractive aspects of MicroWorlds is its ability to create animations. Students are excited by the ease with which they can create even complex animations. MicroWorlds animations require the same mathematical and reasoning skills as turtle graphics. The difference is that the turtle's pen is up instead of down and the physics of motion comes into play. Multiple turtles and "flip-book" style animation enhance planning and sequencing skills. Even the youngest students use Cartesian coordinates and compass headings routinely when positioning turtles and drawing elaborate pictures.

Perhaps the best part of MicroWorlds animation is that the student-created animation and related mathematics are often employed in the service of interdisciplinary projects. Using animation to navigate a boat down the ancient Nile, simulate planetary orbits, design a video game or energize a book report provides a meaningful context for using and learning mathematics.

Functions and Variables

Logo's procedural inputs and mathematical reporters give kids concrete practice with variables. Functions/reporters/operations are easy to create in MicroWorlds and can even be the input to another function. For example, the expression SHOW DOUBLE DOUBLE DOUBLE 5 or REPEAT DOUBLE 2 [fd DOUBLE DOUBLE 20 RT DOUBLE 45] are possible by writing a simple procedure, such as:

```
to double :number
output :number * 2
end
```

Many teachers are unaware of Logo's ability to perform calculations (up through trigonometric functions) in the command center or in procedures. SHOW 3 * 17 typed in the command center will display 51 and REPEAT 8 [fd 50 rt 360 / 8] will properly draw an eight-sided regular polygon.

A favorite project I like to conduct with fifth and sixth graders creates a fraction calculator. First we decide to represent fractions as a (Logo) list containing a numerator and a denominator. Then we write procedures to report the numerator and denominator of a fraction. From there, the class can easily collaborate to write a procedure which adds two fractions. Some kids can even make the procedure add fractions with different denominators. From there, all of the standard fraction operations can be written as Logo procedures by groups of children. The next challenge the kids typically tackle is the subtraction of fractions.

One day, a fifth grader, Billy, made an interesting discovery while testing his subtraction "machine." Billy typed, SHOW SUBTRACT [1 3] [2 3] (meaning 1/3 - 2/3), and -1 3 appeared in the command center. I noticed the negative fraction and mentioned that when I was in school we were taught that fractions had to be positive. Therefore, there is no such thing as a negative fraction.

Billy exclaimed, "Of course there is! The computer gave one to us!" This provoked a discussion about "garbage in - garbage out," the importance of debugging and the need for conventions agreed upon by mathematicians and scientists. We even discussed the difference between symbols and numbers. Billy listened to this discussion impatiently and announced, "That's ridiculous because I can give you an example of a negative fraction in real-life."

Billy said, "I have a birthday cake divided into six slices and eight people arrive at my party. I'm short two sixths of a cake - negative 2/6!" He went on to say, "If the computer can give us a negative fraction and I can provide a real-life example of one, then there must be negative fractions." The hazy memory of my math education diminished the confidence required to argue with this budding mathematician. Instead, I agreed to do some research.

I looked in mathematics dictionaries, but found more ambiguity than clarity. I also spent several weeks consulting with math teachers. Most of these people either dismissed the question of negative fractions as silly or complained that they lacked the time to adequately deal with Billy's dilemma. After a bit more time, I ran into a university mathematician at a friend's birthday party. Roger did not dismiss Billy's question. Instead he asked for my e-mail address. The next morning the following e-mail message awaited me.

Date: Sun, 06 Nov 1994 09:52:44 -0400 (EDT)
Subject: fractions
To: gstager@pepperdine.edu

Dear Gary,

It was fun to have a chat at Ihor's party. This morning I got out my all time favorite source of information on things worthwhile, the Ninth Edition of the Encyclopedia Britannica (with its articles by James Clerk Maxwell et al.). It is very clear. Fractions come about by dividing unity into parts, and are thus by definition positive.

Interesting.

Yours,
Roger

Now what should a teacher tell Billy? In the past, you might hope that he forgot the matter. Today, Billy can post his discovery on the Internet and engage in serious conversation—perhaps even research with other mathematicians. Access to computers and software environments like MicroWorlds makes it possible for children to make discoveries that may be of interest to mathematicians and scientists. It is plausible that kids can contribute to the construction of knowledge deemed important by adults.

New Data Structures

MicroWorlds has two new data structures that contribute to mathematical learning. With the click of the mouse, sliders and text boxes can be dropped on the screen. As input devices, sliders are visual controls that adjust variables. Each slider has a name and a range of numbers assigned to it. Like a control on a mixing board the slider can be set to a number in that range. The slider's value can then be sent to a turtle whose speed or orientation is linked to the value of the slider. The slider can also be used to set the values of variables used in a simulation.

Sliders may also be used as output devices. A procedure can change the value of a slider to indicate an experimental result. If a slider named, counter, is in a MicroWorlds project then the command, SETCOUNTER COUNTER + 1, can be used to display the results of incrementing the counter.

MicroWorlds text boxes also function as both input and output devices. A text box is like a little word processor drawn on the MicroWorlds page to hold text. Text boxes also have names that when evoked report their contents. If a user types the number 7 in a text box named FOO, then typing SHOW FOO * 3 will display 21 in the command center. FD FOO * 10 will move the turtle forward 70 steps. The command, SETFOO 123 will replace the contents of the text box, FOO, with 123. Therefore, text boxes may be used as experimental monitors or calculator displays. Constructing a garden-variety calculator with a text box and MicroWorlds buttons or turtles is deceptively simple, but provides one illustration of how text boxes could be used in a mathematical context.

A basic spreadsheet can be built in MicroWorlds with just one line of Logo code. If three text boxes are named, cell1, cell2 and total, then a button with the instruction, SETTOTAL CELL1 + CELL2, will put the sum of the first two cells in the third. Making the button run many times will cause the "spreadsheet" to perform automatic calculations. A bit more programming will allow you to check for calculation efforts, graph data or cause a turtle to change its behavior based on the result of a calculation. Building a model spreadsheet helps students understand how a commercial spreadsheet works, develop computation skills and add automatic calculation to their Logo toolbox.

Instructional Software Design

Children can use Logo as a design environment for teaching others mathematical concepts. Idit Harel's award-winning research (Harel, 1991) and the subsequent research by her colleague, Yasmin Kafai (Kafai, 1995), demonstrated that when students were asked to design software (in LogoWriter or MicroWorlds) to teach other kids about "fractions" they gained a deeper understanding of fractions than children who were taught fractions and Logo in a traditional manner. These students also learn a great deal about design, Logo programming, communication, marketing and problem solving. Harel and Kafai have confirmed that children learn best by making connections and when actively engaged in constructing something meaningful. Their research provides additional evidence of Logo's potential as an environment for the construction of mathematical knowledge.

Conclusion

Increased access to computers and imaginative teachers will open up an infinite world of possibilities for Logo learning. Software environments, such as MicroWorlds provide children with an intellectual laboratory and vehicle for self-expression. MicroWorlds inspires serendipitous connections to powerful mathematical ideas when drawing, creating animations, building mathematical tools or constructing simulations.

Excursions into the worlds of number theory, fractal geometry, chaos and probability rely on MicroWorlds' ability to act as lab assistant and manager. Paul Goldenberg suggests that it is difficult to test out ideas unless one has a slave stupid enough not to help (Goldenberg, 1993). The computer plays the role of lab assistant splendidly, yet the student still must do all of the thinking. MicroWorlds makes it possible to manage large bodies of data by running tedious experimental trials millions of times if necessary, collecting data and displaying it in numerical or graphical form. The procedural nature of MicroWorlds makes it possible to make small changes to an experiment without having to start from scratch.

MicroWorlds provides schools with a powerful software package flexible enough to grow with students. In days of tight school budgets it is practical to embrace a software environment with which students can address the demands of numerous subject areas. The sophistication with which students confront intellectual challenges improves along with their fluency in MicroWorlds.

Seymour Papert was horrified at how the simple example of commanding a turtle to draw a house, depicted in *Mindstorms*, became "official Logo curriculum" in classrooms around the world. However, providing students with a rich "mathland" in which to construct mathematical knowledge has always been *one* of the goals in the design and implementation of Logo. This paper attempts to provide simple examples of how MicroWorlds may be used to explore a number of mathematical concepts in a constructionist fashion. Those interested in additional ideas should read (Abelson and diSessa, 1981), (Cuoco, 1990), (Clayson, 1988), (Goldenberg and Feurzeig ,1987), (Lewis, 1990) and (Resnick, 1995). More detailed examples and teacher materials related to this paper are available on my World Wide Web site at:

http://moon.pepperdine.edu/~gstager/home.html.

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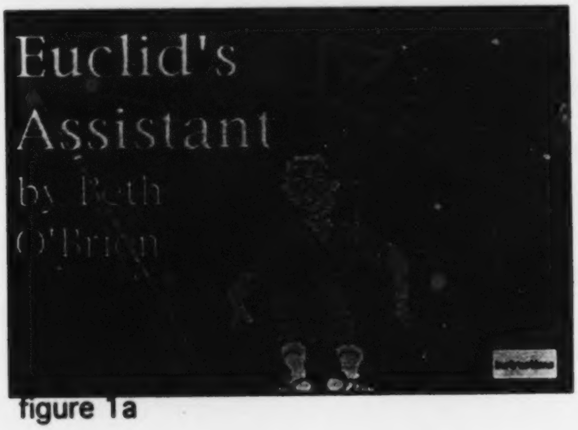
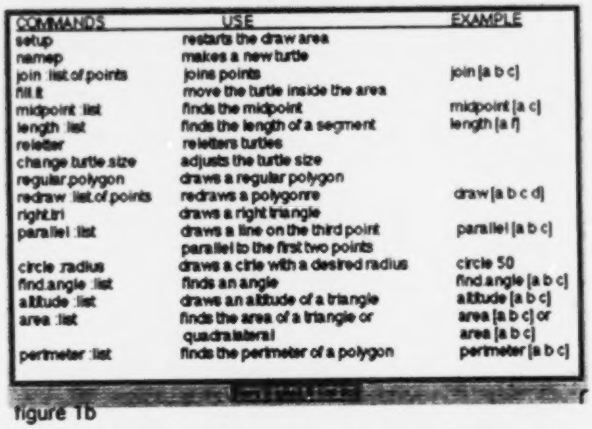
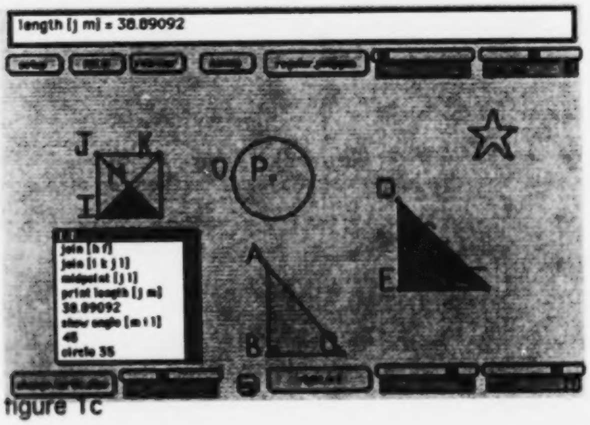


figure 1a



COMMANDS	USE	EXAMPLE
setup	restarts the draw area	
namep	makes a new turtle	
join :list.of.points	joins points	join [a b c]
fill.it	move the turtle inside the area	
midpoint :list	finds the midpoint	midpoint [a c]
length :list	finds the length of a segment	length [a f]
reletter	reletters turtles	
change turtle.size	adjusts the turtle size	
regular.polygon	draws a regular polygon	
redraw :list.of.points	redraws a polygonre	draw [a b c d]
right.tri	draws a right triangle	
parallel :list	draws a line on the third point parallel to the first two points	parallel [a b c]
circle :radius	draws a cirle with a desired radius	circle 50
find.angle :list	finds an angle	find.angle [a b c]
altitude :list	draws an altitude of a triangle	altitude [a b c]
area :list	finds the area of a triangle or quadralateral	area [a b c] or area [a b c]
perimeter :list	finds the perimeter of a polygon	perimeter [a b c]

figure 1b



```
length [j m] = 38.89092
```

```
join [h f]
join [i k j l]
midpoint [j l]
print length [j m]
38.89092
show angle [m i l]
45
circle 35
```

figure 1c

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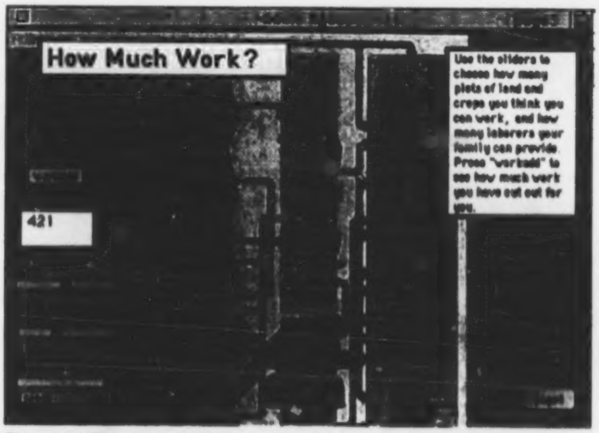
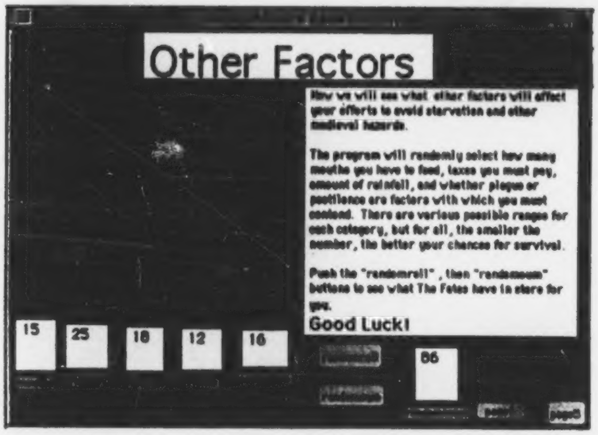


How Much Work?

Use the sliders to choose how many plots of land and crops you think you can work, and how many laborers your family can provide. Press "workadd" to see how much work you have cut out for you.

figure 2a



Other Factors

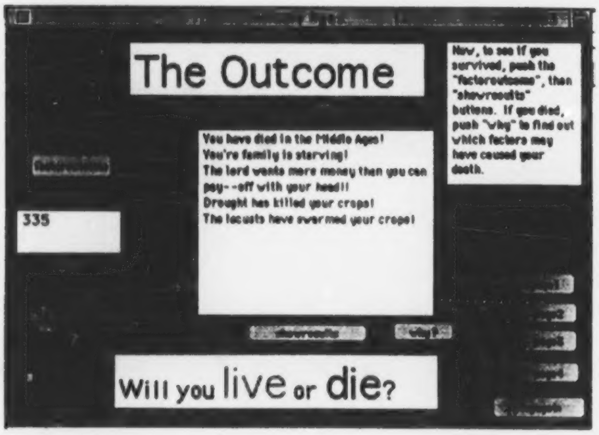
Now we will see what other factors will affect your efforts to avoid starvation and other medieval hazards.

The program will randomly select how many mouths you have to feed, taxes you must pay, amount of rainfall, and whether plague or pestilence are factors with which you must contend. There are various possible ranges for each category, but for all, the smaller the number, the better your chances for survival.

Push the "randomroll" , then "randomsum" buttons to see what The Fates have in store for you.

Good Luck!

figure 2b



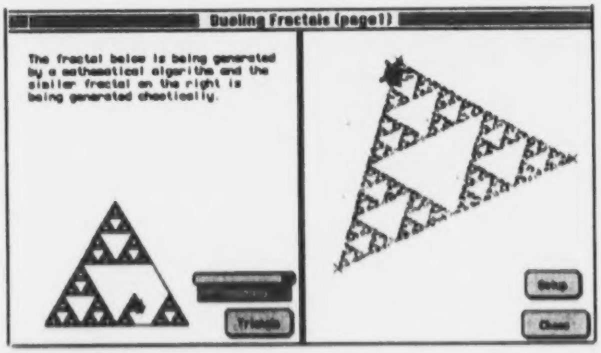
The Outcome

Now, to see if you survived, push the "factoroutcome", then "showresults" buttons. If you died, push "why" to find out which factors may have caused your death.

You have died in the Middle Ages!
You're family is starving!
The lord wants more money than you can pay--off with your head!!
Drought has killed your crops!
The locusts have swarmed your crops!

Will you live or die?

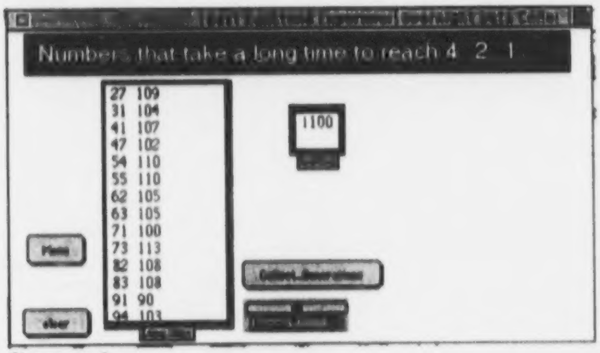
figure 2c



Dueling Fractals (page1)

The fractal below is being generated by a mathematical algorithm and the similar fractal on the right is being generated chaotically.

figure 3



Numbers that take a long time to reach 4 2 1

27	109
31	104
41	107
47	102
54	110
55	110
62	105
63	105
71	100
73	113
82	108
83	108
91	90
94	103

figure 4a

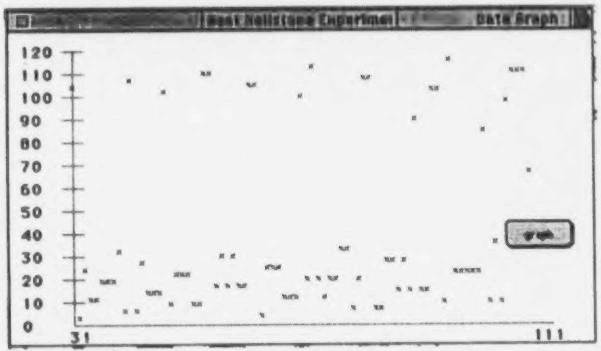


figure 4b

Paper Session

Access and Attitudes Regarding Online Services Among Socioculturally Diverse Students

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Key Words: access to technology, attitudes, Internet, equity in education, online, multicultural, World Wide Web

Abstract

Socioeconomically diverse college students from Arizona and California were questioned on access-related attitudes toward using online services and the Internet. Notably, students with current access to online services had positive beliefs that the services would improve their academic and career opportunities. In contrast, students without access had little interest in using online services in the future and saw little personal relevance in the technology. The implications of the research are discussed.

Introduction

The enlarging social significance of online services (commercial services, the World Wide Web, and the Internet), the industry imperative to use them, and their pedagogic promise have established access to online services as a national issue and perhaps a global concern (see Gore, 1992; Thorngate and Klejner, 1990). Many studies have addressed the negative attitude, opportunity, and career implications of limited access to computers, but in spite of burgeoning interest in online communications, only scant data exist regarding the effect of access on people's intentions to use online services in the future. This study establishes that access to computers does not equate to access to online services and furthermore, the study demonstrates that attitudes toward computers and online services are not necessarily equivalent. The study also provides fundamental information on the impact of differential access to online services on the attitudes and choices of socioculturally diverse college students regarding the use of online services now and in the future.

Method

Data were gathered during early 1996. Subjects were 710 students from two community colleges (GCC, MCC) and one university (ASU) in the Phoenix, Arizona, area and two community colleges (SDCC, SWCC) and one university (UCSD) in the San Diego, California, area. Ages ranged from 18 to 59. The average age was 24.8. The overall ethnic distribution of the sample was 12% African-American/Black, 15% Asian, 51% Caucasian/White, 4% Native American, 18% Hispanic, and 1% Other (not specified). Colleges and universities with different admissions standards and educational foci were selected to determine whether students in these disparate institutions have significantly different attitudes toward using online services. The schools offered disparate provisions for access to online services. The researcher subjectively assigned a rating of high or low access to each school based on the access provisions offered. (Refer to Table 1.)

Measures and Scales

A 4-page, booklet-style questionnaire employed three types of attitude measures: (a) single-item Guilford self-rating attitude scales as direct attitude measures to validate the index measures in the study, as suggested by Pryor (1992); (b) a semantic differential scale based on items from Hiltz (1994) to measure global attitudes toward using computers and global attitudes toward using online services, referred to as the online attitudes measure and the computer attitudes measure in the narrative; and (c) a belief-evaluation index, developed on the method suggested by Pryor (1992), to measure the attitude toward the behavior of using online services. The questionnaire also employed an intention measure comprised of five scale items to determine intention strength for using online services in the future. The bipolar probability scales, the semantic differential scales, the intention scales, and the Guilford scales were scored from 1 to 7. For statistical analysis, the number 4 was subtracted from the score for the bipolar scales used to calculate the belief-evaluation index, to yield item scores of +3 (extremely good) to -3 (extremely bad) through a midpoint of zero (neutral or neither good nor bad).

Table 1. School Selectivity, Sample Ethnicity, and Online Access Provisions

	ASU	UCSD	GCC	MCC	SDCC	SWCC
Admissions Selectivity	Moderate	High	Open	Open	Open	Open
Ethnic Sample						
White	74%	62%	64%	68%	25%	9%
Black	7%	11%	10%	7%	25%	9%
Hispanic	7%	1%	6%	5%	22%	70%
Asian	10%	25%	19%	10%	18%	11%
Online Access	High	High	High	Low	Low	Very Low

The belief-evaluation scales, based on Pryor's (1992) implementation of the theory devised by Fishbein (1963, 1967), were incorporated because the theory offers an exploration of the cognitive and affective variables that determine attitude. The theory also offers utility in the development of focused, prioritized interventions that may be able to affect the salient beliefs toward a behavior that have substantiated the theory's utility for changing attitude in the desired direction (Lutz, 1973; McArdle, 1972).

Based on the model, in the present study the attitude toward the "behavior of using online services" is formed by a set of beliefs about outcomes (belief strengths) of performing the behavior and a corresponding evaluation of each outcome. Fifteen evaluations of behaviors and outcome beliefs (gathered from a representative sample of students in a focus session) about the results of using online services were employed to measure attitude toward using online services. An analysis of the attitudes measured from these belief and outcome statements provided information about the relative importance of the elicited beliefs in the formation of attitude toward using online services.

As suggested by Pryor (1992), the evaluations of the general outcomes preceded the belief statements about online services on the instrument. The evaluation and belief statements were ordered the same. The evaluation statements were operationalized as seven-point bipolar probability scales with endpoints labeled Extremely Good and Extremely Bad. The belief statements were operationalized as seven-point, bipolar probability scales with endpoints labeled Strongly Agree and Strongly Disagree. The evaluation and belief statements used in the instrument are listed below.

Evaluations of Outcomes (Section 8 of the Research Instrument):

For you, how do you feel about the following (from *Extremely Good* to *Extremely Bad*)?

Increasing the cost of my education
Making it more difficult to get a job
Communicating more effectively with teachers
Gathering more information for school assignments
Exchanging ideas with people from around the world
Getting current information in your areas of interest
Learning new computer skills
Succeeding in a career
Getting the news faster
Improving productivity
Making communications less personal
Getting information about new products
Spending more time using a computer
Communicating faster with people
Making life simpler

Outcome Beliefs Toward Online Services (Section 9 of the Research Instrument):

For you, using online services would result in the following (from *Strongly Agree* to *Strongly Disagree*):

Increasing the cost of my education
Making it more difficult to get a job
Communicating more effectively with teachers
Gathering more information for school assignments
Exchanging ideas with people from around the world
Getting current information in your areas of interest
Learning new computer skills
Succeeding in a career
Getting the news faster
Improving productivity
Making communications less personal
Getting information about new products
Spending more time using a computer
Communicating faster with people
Making life simpler

Data Analysis

For inferential analyses, scores on all bipolar items and indexes were considered interval data. The ordinal bipolar probability and self-rating item scores were treated as interval data in most inferential analyses. Fishbein (1963) hypothesized that the summated belief-evaluation products (evaluation score x belief score) for each pair of items in appropriately constructed belief-evaluation scales forms an estimated measure of attitude (in this case toward the "behavior of using online services"). This theoretical belief-evaluation product was calculated for the paired items in Sections 8 and 9 of the instrument. The sum of these belief-evaluation products was the "belief-evaluation index."

Results

Access Variables by School, Ethnicity, Gender, and Income

The sample differed significantly by Chi-square analysis by school on all three access variables (computers at home, e-mail accounts, and modems). Notably, the samples from SDCC (51%) and SWCC (38%) had the lowest percentage of computers with modems. MCC (32.7%) and SWCC (16.3%) had the lowest percentage of e-mail accounts. The sample from UCSD was exceptional in indicating 93% access to a computer with a modem at the current place of residence. Likewise, almost all of the UCSD respondents (96%) had personal e-mail accounts.

The Caucasian/White, Asian, and high income respondents had the highest percentage of computers and e-mail accounts. Hispanic and African-American respondents had the lowest percentage of computers and e-mail accounts.

Differences in access by gender were not significant. These results parallel recent national results that indicated that African-American and Hispanic families have significantly few computers at home and at school than White families (Floyd, 1996).

Correlation of Attitude, Belief, and Intention Measures

Pearson product-moment correlation coefficients compared associations among the belief-evaluation index, attitude measures, intention measures, and usage variables for the entire sample. There was a very low, non-significant association between the current online usage measure and the computer attitude measure, contrasting with the significant, r = .45, correlation between current online usage and the online attitude measure. This indicates that attitudes toward using computers were not predictive of online usage.

Of importance, the high (r = .80) correlation between the belief-evaluation index and the attitude toward online services established congruent validity among these two measures of attitude toward using online services. There was also an almost high (r = .65) correlation among the belief-evaluation index and the measure of future intention to use online services. This indicates that those students who believed in the value of online services also intended to use online services. In contrast, users without access to online services had low belief-evaluation scores as well as low intention scores, meaning that current access to online services affects the belief in the value of online services as well as the intention to use them in the future.

A similar significant level of correlation (r = .61) was seen among the online attitude measure and the intention measure. The lower correlation of the intention measure with the computer attitude measure (r = .35) and the computer usage measure (r = .31) is notable. Again, this indicates that computer attitudes cannot be used to predict attitudes toward online services or intention to use online services. The low association (r = .15) between the measures of current computer usage and current online usage is also of interest, indicating that the measures of computer usage and online usage exhibit discriminant validity when compared to other measures. This means that computer usage was not a strong predictor of online usage.

Comparisons by Demographic Variables

Ethnic Comparisons

The mean belief-evaluation indices of the Hispanic, Native American, and African-American/Black groups were significantly lower than the Caucasian/White and Asian groups. The low-scoring groups also had the lowest mean scores on (a) the intention (to use online services) measure, (b) the current computer usage measure, and (c) the current online usage measure. The Hispanic group had noticeably lower mean scores than the other low-scoring groups for computer and online usage. In contrast, the Asian sample had the highest mean scores on the online usage measure. The Caucasian/White and Asian groups had the highest mean computer usage scores.

Income and Gender Comparisons

The lower income groups (those with annual income below $35K) had significantly lower scores by t-test on the attitude, intention, and usage measures than the higher income groups. The high intention score for the group with income over $100K (M = 25.53 of possible 30) contrasts with the low intention score of the below $15K income group (M = 13.73). Of special interest are the lower mean belief-evaluation indices for the low income (M = 31.9) group compared to the high income group (M = 62.1).

The comparison of attitude, intention, and usage measures by gender were not significant for the belief-evaluation, attitude toward using computers, or current computer usage measures.

Users Versus Non-Users

People who had used online services within the last year accounted for 68% of the sample (N = 485). Non-users accounted for 32% of the sample (N = 225). Of the non-users, 54 (24%) were non-native English speakers. Of these, 46 (85%) were native Spanish speakers and 35 of these were from SWCC. There were no other notable ethnic, gender, or age patterns among the users and non-users. Significant differences were noted on the mean attitude and intention scores between users and non-users. The differences in correlation between the intention measure and the belief-evaluation index attitudes are particularly striking when comparing users (r = .67) and non-users (r = .31).

The Belief-Evaluation Index and Predicted Intention to Use Online Services

To explore the ability of the model to predict intention to use online services, the intention measure was regressed on the belief-evaluation index. The ability of the belief-evaluation model to explain intention is based, in part, on the beta weight (standardized regression coefficient) derived from the regression analysis. The results of regression were: Standardized Beta = .636, p < .001; unadjusted R2 = .404; and adjusted R2 = .403. Thus, about 40% of the variability in the intention score was predicted by knowing the belief-evaluation index score.

The mean differences between groups on the belief-evaluation index were most evident when students with and without e-mail accounts were compared. Those without an e-mail account had a mean score of 36.1 on the index, whereas those with an account had a mean score of 56.9.

High and Low Intention Comparisons

Respondents with a high intention to use online services had much higher belief strength (M = 2.26) about the outcome associated with using online services in succeeding in a career than the low intention group (M = .42). Similar striking differences were apparent in the high intention groups' beliefs about outcomes associated with online services' ability to help them communicate faster, make life simpler, and communicate more effectively with teachers. The belief-evaluation index scores were more influenced by the belief strengths associated with using online services than by the evaluation of the 15 outcomes used to define the scale. Thus, there was stronger belief among the high intention and high access groups that online services would result in specific positive outcomes (such as succeeding in a career or making life simpler) or not be likely to result in specific negative outcomes (such as increasing the cost of education or making communications less personal). For the low intention and low access users the opposite was true. The low intention group had similar scores in the evaluation (importance) of the outcomes, such as succeeding in a career or getting news faster, but had less belief strength that online services would be positively associated with these outcomes for them personally.

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Discussion and Conclusions

The results were consistent and significant: Access factors, including the availability of a computer at home with a modem, possession of an e-mail account, and the level of online access provided through the school, were correlated with beliefs about the benefits of using online services (the outcomes) at moderate to very high levels. In contrast, attitudes toward computers were generally similar among groups, regardless of school or home-based access, even though the attitudes toward using online services were significantly different based on the degree of access the individuals had to online services.

Anyon (1980) pointed out that attitude differences are a concern if they are related to behavioral choices that undermine the occupational and educational choices of individuals. This study demonstrated that access toward online services had measurable effects on individuals' intentions to use online services in the future. The lack of intention and the lack of perceived benefit of online services, as measured in this study, may limit the low-access people's occupational and educational choices regarding the future use of online technologies. For this reason, the attitude differences are worth consideration and further study.

Based on this study, it is incumbent upon educators to assure that students receive equal access to technology at early stages because it does indeed affect their intentions to use the technologies that can most benefit their future educational and occupatonal opportunities. This study also reveals that providing skills using computers are not sufficient to instill an interest in online services. Skills using online services must be targeted as a separate focus of training. This is especially important when considering that a lack of computer skills, including online skills, is projected to lead to economic hardship in the next century among those who find themselves overrepresented in the slowest-growing occupations, requiring the fewest technical skills.

Ethnic, Income, and Gender Variables

The high income groups generally had more positive attitudes toward using online services. The highest income group (annual family income over $100K) had remarkably more positive attitude and intention scores than groups in lower income levels. This reinforces statistics characterizing online users in the US population with high income, high education demographic profiles. However, the issue of ethnicity and attitudes were so intertwined with issues of socioeconomic advantage, that as in other studies, it was difficult to separate the ethnic issue from the socioeconomic one. In this study the majority of Hispnic respondents and many of the African-American respondents came from lower income households and attended the schools with the fewest provisions for online services. These students had the lowest mean attitude scores toward online services. Since many of the Hispanic students were also native Spanish speakers, even though language was not a significant factor in predicting attitudes, there may be linguistic issues embodied in the data that are impossible to discern with the instrument used in this study.

In contrast, the strong positive attitudes of the Asian students (also non-native English speakers) point to a possible cultural priority placed on the use of online technology among these students. Not only did the Asian respondents have high grade point averages, but they also had the highest intention scores and the highest availability of computers at home. Although the sample was not large, notably the Asian students in low-income schools also had high percentages of computers with modems at home compared with other low income students. The data may point to cultural influence on the motivation to acquire access, something beyond the scope of the study that deserves more inquiry.

The Need for a Focused Research Agenda

The determination that high scores on computer attitude scales did not necessarily predict high scores on measures for using online services is important to educators and researchers. Although there was low-level predictive power in computer attitudes as they relate to beliefs about using online services, the association was minimal when compared to the predictive power of access to online services (not computers per se) and prior experience with online services. Thus "liking" a computer is not prerequisite to liking online services (or vice versa). These results substantiate the need for a separate research focus for measuring the factors affecting the usage and acceptance of online services as contrasted to research on using computers in general.

Intention, Beliefs, and Attitudes

The study substantiated the viability of the attitude measurement component of the theory of reasoned action (Fishbein, 1963, 1968), in the format proposed by Pryor (1992), as a useful analytic tool for understanding the relationship of beliefs, attitudes, and intentions toward using online services. The patterns of belief strength and attitude associated with high and low intention groups and high and low access groups were similar and revealing. Intention to use online services was significantly associated with the belief-evaluation index as well as the index measuring current usage of online services. This supports similar research regarding experience with computers that associates both positive attitudes and intention to use computers with experience with computers (e.g., Kulik and Kulik, 1991).

Further, the analysis of the belief structures regarding the use of online services point to specific belief-structures that are central to people's intentions and usage of online services. Some of the important attitude determinants among high intention and high access users regarding the use of online services were specific outcomes associated with productivity, career success, gathering useful information, and improving school-related communications with teachers. Through understanding the specific differences in the beliefs of those who do and do not intend to use online services, it may be possible to develop specific experiences to use online services that may change these beliefs in ways that could influence future use of online systems to people's advantage. Such interventions may be necessary to assure that all members of society are given fair opportunity to use online services.

Rather than simply assuming people will enjoy using online services, the information provided in the present study might be efficaciously applied to specific programs that would help low-access and low-intention groups to improve their motivations toward using online services. For example, eucational programs that demonstrate the importance of online services in industry might affect the low intention groups' attitudes toward the importance of online services in their future careers. Many of the beliefs are directly associated with the students' attitudes toward school and this is apparent in the predictive relationship of high GPA and a high score on the belief-evaluation index. Thus, other interventions might focus on establishing the utility of online services to improve success at school.

Students in school today will spend most of their lives in the 21st century. Skills necessary in this future will include the ability to use, embrace, and master computer-mediated communication technologies and online services (Smith, 1992). Thus, uncovering issues involved in motivating people to use and master online services systems becomes increasingly important. In that vein, this study provides revealing data on the association of low access and low income with lower intentions to use online technology and lower expectations of the online technologies (as evidenced by the generally lower "belief" scores for the low income and low access groups).

Access to online services was not equitable among the six schools studied. Whether these six schools are representative of institutions of higher education at a national level remains to be assessed. However, in this study, the sample clearly demonstrated the divergent attitudes of the "haves" versus "have nots" regarding online services. In this study even though students were provided access to higher education they were not provided with equal opportunities to develop relevant technological skills.

A Call for Equity and Action

Developing an educational system that provides opportunity equity seems a worthwhile goal for higher education. This study justifies Anyon's (1980) focus on the implications of attitudes in establishing equity in educational settings. The attitudes of the low income, low access students in this study are a concern because attitudes are predictably associated with low intentions to use online technologies and the students' unenthusiastic beliefs regarding the importance of using online services in their careers and education. A technologically literate person must see merit in spending the time to learn a technology, as well as merit in the use of the technology. Participants must perceive value or gain some social benefits or otherwise or they will not choose to use technology. Both contact and access to the systems are required, as well as positive attitudes toward the technology. This study has shown the importance of extending the research in these areas.

The implications of this incipient study embody lost career opportunities, disparate access to information, and unequal abilities to participate in 21st century society. The implications of this study demand serious attention in terms of (a) funding for online access, (b) expanded, applied research, and (c) informed educational interventions.

The educational challenge centers on providing appropriate opportunities for all people to attain the experience and skills necessary to prosper in the future, including the ability to use online services. Opportunities by definition depend on access to the technologies. A first step to understanding how to provide these opportunities involves understanding how access, attitudes, and motivations to use technologies may be related, as has been started in this work. That knowledge can help educators facilitate appropriate learning experiences to equip people with the online skills necessary to compete in the future.

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Paper Session

Integrating Groupware Into Professional Development Programmes for Dynamic Distance Learning

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Abstract

Groupware tools supporting multimedia and asynchronous communication provide flexible learning opportunities, allowing interaction with a vast array of resources. This paper explores the use of groupware to promote dynamic learning partnerships. We examine the use of such systems to support collaborative group activities and to provide support for professional development. A key focus is the pedagogical principles underpinning the design and management of groupware systems.

Introduction

Groupware tools that support multimedia and asynchronous computer-mediated communication (CMC) are changing teaching and learning patterns. Groupware environments provide opportunities for learning in flexible yet cost-effective ways: from distributed locations and within flexible timeframes. They allow learners and tutors to draw upon, and interact with a vast array of resources: using them to define problems; to represent ideas in different media; and to augment the resources with personal commentary, questions and alternative viewpoints.

Groupware tools are already used widely, to support many different working practices (although there is still relatively little use within learning contexts). They often have limited success, partly because they are not designed around the needs and goals of specific users and also because the relevant social knowledge of group working has had little influence (Galegher, Kraut, and Egido, 1990). An additional factor is that such systems are often highly flexible: they can be configured in any number of ways, often offering very different functionality and features between different configurations. As yet there is no clear guidance on linking the functionality and affordability of the technology to the requirements of different models of use and to the stages of group collaboration (though see Mandviwalla & Olfman, 1994, for more detail of generic groupware requirements).

With these concerns in mind, this paper explores how a groupware system is being used to promote dynamic learning partnerships: between educational providers and a specialist practitioner community; between tutors and learners; and between learners and learners. We begin by describing a professional development program that utilizes communication technologies for a flexible learning network. The program's switch to using Lotus Notes™ as its groupware system, has enabled a critical re-assessment of technology-based group learning environments. We explore some aspects of our use of Lotus Notes with a discussion of how multimedia groupware systems can be used to support collaborative group activities and provide rich support for professional development. The main focus of the paper is the pedagogical principles underpinning the design and management of groupware systems.

The ALT Programme

The Advanced Learning Technology (ALT) program is a modular, part-time distance learning program at Lancaster University. It supports the acquisition and development of the skills needed to design, develop, use and evaluate IT-based learning materials. Participants are involved in all aspects of IT-based learning within higher, further and adult education, and within training contexts. The program contains 12 independent modules. Each module combines two discrete residential study periods with approximately 12 weeks of independent home- or work-based study. Between the residentials, learners maintain contact with tutors and peers through the groupware system (see also Goodyear, 1994, Steeples, and Valley, 1996).

The use of a groupware system for communication helps alleviate the sense of isolation that distance learners can often feel. It provides a supportive environment where learners can communicate with tutors and, most importantly, can exchange knowledge and experience with one another. They can discuss issues raised by the course material, receive feedback on proposed assignment tasks, input ideas for residential sessions—in fact, anything that members of a more traditional course would discuss face-to-face. Moreover, with an asynchronous system (i.e. one that does not require all communicators to be connected at the same time) the participants can do this from home or from work, and at times which most suit them. The asynchronous communication also gives more equal opportunity to all to participate in discussions than is often possible in face-to-face settings; flattening the relationships between tutors and learners, and between learner and learner, that is essential for acknowledging prior expertise and experience.

CMC has been an integral part of the ALT program since it began in 1989. We now use Lotus Notes, a groupware system that supports many different forms of shared workspace. Our change to Notes in 1995, coincided with its adoption as the University's centrally-supported group-based system (Armitage and Bryson, 1996) and has provided an important opportunity to re-assess how CMC is used within our program. It has enabled us to evaluate the ways in which groupware can provide effective learning support for widely dispersed groups, both now and in the future.

ALT Professional Practice

The learning technologies profession is multidisciplinary. Its members include training analysts, instructional (courseware) designers, subject-matter experts, conventional training specialists, evaluators and project managers. Most ALT workers carry out several of these functions, work closely with specialists in other functions and need to understand the nature of all the tasks involved (Goodyear and Steeples, 1993, Steeples, 1993).

The ALT program is geared to meet the emerging needs of this increasingly broad group of professionals. Their needs are subject to the dynamics of a rapidly evolving field, especially in technological developments. This is further compounded by the growth of the field itself as a profession in its own right, and the accompanying pressures for career structuring and professional recognition through formalized means.

Our work with the ALT professional community has led us to realize the limitations inherent in a prescriptive, course-based approach to ALT professional development. We need to acknowledge the professional expertise of our learners. In addition, experienced adult learners demand a high degree of control over the scope and the nature of their learning. The "open" approach of the ALT program is designed to address some of these issues: e.g. in supporting learner flexibility; strengthening links between the program and learners' ongoing workplace concerns; and through active participation in tasks that closely represent the real world situations in which they are embedded (Brown, Collins, and Duguid, 1989).

For most people, participation in the ALT program must be fitted around the demands of full-time employment, family life, and many other commitments. The modular structure and flexible approach of the program, combined with the normal facets of distance learning, help ease the burden of conflicting demands. This model of learning has the potential to provide access to training and education for a much broader range of people than more traditional approaches. The use of learning technology in the form of groupware for computer conferencing further enriches that experience, removing the geographical boundaries and constraints of time and place often imposed on those seeking professional and personal development.

In the next section we begin to examine more closely the notion of online support for group learning. We look at how groupware systems provide new, exciting opportunities to support the sharing of knowledge and practice. This is followed by an account of some of the ways we are using Lotus Notes. In particular, we suggest how we can use the environment to support and integrate new members into the ALT professional community network: the integration of "newcomers" through "guided participation" (Lave and Wenger, 1991, Rogoff, 1991). Finally, we conclude with some insights into our future development plans for using the groupware environment on this program.

Computer-Supported Collaborative Learning

Our main research interest, mirrored in the work that we do on the ALT program, is to examine new ways of learning that are possible in electronic environments supporting collaboration (groupware). To do this we need to gain a clearer understanding of the nature of collaborative learning as it occurs in online group-based activity, and of the technological tools needed to support it.

Collaborative learning is a specialized type of group collaborative activity. Key benefits of collaborative learning are that it supports active learning and deep processing of information. Collaborative learning is valued because it helps clarify ideas and concepts through discussion. It develops critical thinking, communication and coordination skills, and informs learners about the construction of knowledge. Collaborative learning provides validation of individual ideas and ways of thinking through conversation (verbalizing), multiple perspectives (cognitive restructuring) and argument (conceptual conflict resolution). It fosters knowledge about the learning process and therefore encourages a spirit of learning to learn (McConnell, 1994).

Computer-supported collaborative learning enriches this provision by allowing learners opportunities to share ideas and information within a social context, but one where they have flexibility to control their own learning. It also promotes the development of learners' technological skills and confidence without necessitating the need to make technology the focus of the learning. In this way, the technology remains the medium of communication, not the message of it.

Multimedia groupware systems such as Notes make it possible to transmit a variety of media (text, graphics, audio, video), and to organize information in new ways. Use of a variety of media can aid in the sharing and processing of information. Different media can be used to highlight different aspects of content, saving learners from difficult mental elaborations. Innovative approaches to problem solving by using rich and multiple representations can be encouraged, enabling recognition of new dimensions and perspectives. Groupware tools support not only the communication of ideas and information, but also the creation of "mediating representations" that help learners understand what they and their peers know and do, and from this to better define their own learning goals. Learners can create representations or artifacts to capture professional practice that can be augmented collaboratively, thus assisting the process of building group knowledge (Resnick, Levine, and Teasley, 1991, Dix *et al.* 1993).

The groupware technology we use preserves the discussions and artifacts that are created collaboratively. This makes them permanently accessible to all members of the community. Hence all members (and this may be especially valuable to new members) have equal access to this developing pool of common practice and knowledge (Goodyear and Steeples, 1993).

Why Choose Lotus Notes for the ALT Professional Community?

We have earlier expressed concerns that groupware tools are limited in their fit to the need for people to participate effectively in groupwork. There are however, specific features in the design of Lotus Notes that we believe support and enable collaborative processes. These factors have influenced our choice of Notes as the system for the ALT program and we will briefly outline just four of them here.

Firstly, the *behavioral processes* of group development include establishing consensus, sharing power and encouraging participation (Mandviwalla, 1994). These processes can be operationalized in Notes. For example, consensus can be optimized by imposing deadlines and setting time constraints. We have used this feature in some of our discussion databases, where prolonged discussion is felt inappropriate. Power is also more evenly shared in the community by the equality of opportunity to participate.

Secondly, the *mechanical aspects* of group development, such as maintaining group memory is a fundamental feature of systems such as Notes. The system is primarily asynchronous, and this allows a permanent record of interactions to be retained: for future communal planning and growth; and for individual reuse and reflection.

Thirdly, Notes can support the creation of multimedia collaborative artifacts or documents that capture professional practices and knowledge. As well as being able to incorporate graphics and sound files directly into Notes documents, it is possible for participants to share documents from different applications as Notes attachments. This can make it extremely easy for our distributed learners to share artifacts that capture elements of their work, and that can be augmented and refined through group debate.

Finally one of the main advantages of using Notes for distance learners is the integrated support provided for offline working. Offline working can effectively minimize the costs of remote connection for collaborative working and communication, because connection to the server is only made to send and receive new messages/information. The process of updating is known as replication. It is also possible to set the replication process to occur during off-peak hours, further minimizing connection charges. Offline working thus allows individual flexibility *and* remote collaboration.

Structuring the ALT Online Space

The different areas of the ALT environment are organized in relation to physical spaces and metaphors from the office world. Notes provides a number of levels that we allocate to different areas of activity: e.g. at departmental level, at program level and at modular level. At the program level, participants can find areas relating to general program information, administrative news, a technical queries collection, a glossary of ALT terms, as well as a general social space (the café). At the modular level, each module has its own discussion space, divided into sub-areas called topics. Typically, topics will include general, module-specific discussions; discussions about particular readings; and discussions about individual assignment ideas. Notes presents the topics and their responses in a linked and visibly ordered structure. Within a topic, participants can add their comments or questions as responses. In the design of our discussion databases, it is also possible to respond to a response. It is also possible to bridge directly across the Notes hierarchy between different locations within the environment. We can do this by using the Notes link facility.

Individual organization of the environment is in part supported. Participants may organize their desktop folders to suit their own needs. An example desktop folder is shown in Figure 1, below.

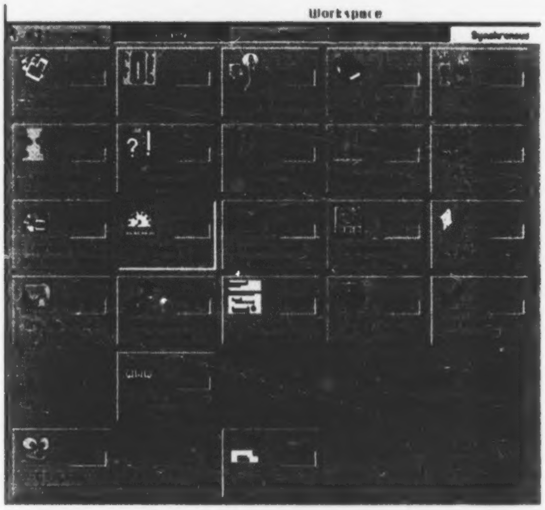

Figure 1. Individual organization of the desktop

Integrating ALT Newcomers

An important consideration in the design of the ALT program that continues in the day-to-day management of the online environment is how we can provide careful support to integrate new ALT members into the learning community. In complex group environments like ours, ongoing support "provides an important means for socialization and acculturation" (Rouse, Cannon-Bowers & Salas, 1992, p. 1296).

The environment permits peripheral participation in the study and social activities. As a result, new members become committed to it (Lave & Wenger, 1991, Eveland & Bikson, 1988). The modular structure of the program permits new members to join at all points in the year. It is also designed to encourage experienced course members (alongside tutors) to support newcomers (Rogoff, 1991). The modular structure ensures there is a blend of experience of the program on any module. Learners find themselves studying alongside others well established in the program and with ones who have more limited experience of the program.

The modular discussion databases help to creating visible boundaries for different types of discussion, that new members can browse through. It is through a first stage of browsing that new members discover the tenor of contributions, and learn the styles of discourse of the community. From this , it often follows that new members will direct their first questions or contributions to the tutors, usually in a private message. The tutor can give direct support here by developing the content of the message into a public contribution. This form of cognitive scaffolding can work extremely well and give the learner confidence, especially if the public contribution makes obvious clues (to the new member at least) of its original source. Confidence gained in this way, will often lead to personal action to make one's own public contributions.

There are other strategies that tutors can use to encourage immersion into the online community. Simple steps like keeping contributions focused and informally presented (e.g. leaving in typos and spelling errors) are proactive measures that send encouraging messages to new members. Finishing a contribution with simple direct questions can also stimulate a response.

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While in the short-term our suggested levels of support can be intensive for tutors, these activities can nevertheless be arranged to fit around other commitments, because of the asynchronous form of communication. The benefits are reaped in the long-term. Decreasing effort is required from tutors as learners take more and more active control over their own learning and provide increasing support to each other.

Future Developments

The highly customizable nature of Notes enables the developing and evolving needs of users to be accommodated. This customization currently tends to be at the individual user level, rather than at the group level. The range and complexity of Notes features can make it a difficult system to use initially, but its richness of features mean that it is a system that we can adapt as our end-user group-based requirements become clearer and better specified. "Lotus Notes is slowly evolving toward a meta-environment type of system" (Mandviwalla and Olfman, 1994), that is one which will allows the local designer/user to select the features they need for a specific task, and to adaptively structure the environment to fit an intended purpose.

Our contemporary development work is in the area of Notes/Web integration. For this, we are using Domino™. Domino is both a Notes server and a Web server, enabling Notes bi-direction interaction with a normal Web client. Notes databases are displayed on the Web in a very similar format to within Notes itself and with similar features (e.g. of differing Notes Views). Notes automatically generates the HTML code for displaying documents, and for document links. It is effectively offering us a multi-user Web authoring environment operating within the security of a localized environment. The integration of Notes with the Web will offer several advantages for our ALT professionals: it will avoid users needing to learn to use another system; it will enable automatic creation of Web materials by users (including novices); and it will facilitate more open access to our Notes databases that will enable us to provide an ongoing service to the wider ALT community.

The benefits of asynchronous communication for flexible, distance support and reflective learning activity have been a major focus in our research and use of CMC tools. We also realize that certain stages and types of group activity require rapid interaction, that is better supported in synchronized communication. This is leading us to examine the new functionality offered in Notes environments to merge synchronous and asynchronous forms of collaborative exchange and expressly to look at the migration of elements of synchronized interactions into the asynchronous environment for reflective activity.

Conclusion

We have described some issues in the educational use of groupware tools to support distance learning. Multimedia groupware have the potential to provide technological support for collaborative working and learning activities between dispersed groups. The design and customization of tools needs to be informed by a sound analysis of the pedagogic goals they are intended to support.

Notes is based largely on the bulletin board metaphor and therefore has a static feel to it, in terms of support for the dynamics of group processes. However, as new tools emerge that move us towards an integrative environment (e.g. with the Web, and between synchronous and asynchronous communication), we will be able to provide participants with a broader range of features for effective group-based learning.

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K–16 Computer Science

Revitalizing High School Computer Science: Finding Common Ground?

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Key Words: **computer science, curriculum, high school**

This presentation examines the larger curriculum reform issues: keeping current despite constant change, meeting student needs and university demands, and keeping a grip on reality.

Introduction

Over the last few years many, schools, districts, states, provinces, countries and even international organizations have tried to review and revitalize the high school computer science curriculum, with varied amounts of success. Panel members will discuss their experiences of curriculum reform committees and provide suggestions for bringing all of the stakeholders together to achieve real change at the classroom level.

The absence of a standardized and timely computer science curriculum has been a mixed blessing for high schools and a tribulation to college computer science departments. At the high school level, it has given proactive teachers an opportunity to step beyond existing guidelines to provide interesting and relevant courses. Unfortunately, though, it has also resulted in the use of outmoded technologies and pedagogical methods. At the university level it creates marked differences between first-year students, affecting their ability to comprehend college-level course material and their appreciation for the rigor and complexity of the discipline.

While the goal of most curriculum design projects is to bring people together to develop a new curriculum which all can endorse, many of these committees, however, ignore the fundamental differences in expectations, ability, and audience which make the high school environment unique. They also fail to recognize the commitment required to insure that teachers receive adequate upgrading and inservice.

Panelists will discuss the different roles high schools and universities can play. The audience will also be encouraged to submit their experiences of the reform process.

Workshop

Joining Hands: Starting an Elementary School-Wide Keyboarding Project

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Key Words: **keyboarding, parent involvement, corporate sponsor, business partnerships, school-wide project, elementary**

"Mrs. Stone, where is the 'a' key?" Students asked questions like this frequently, before we implemented our school-wide keyboarding project. The Shaughnessy Humanities School in Lowell, Massachusetts, is an elementary school with 540 students, from pre-school through grade four. Principal Linda Lee, Assistant Principal Roberta McBride, and consultant Skip Stahl of C.A.S.T. (Center for Applied Special Technology in Peabody, Massachusetts) along with our expert faculty and staff orchestrated the use of Sunburst's *Type to Learn* program for the 1996–997 school year.

First came staff development. As the computer teacher, I trained faculty in the application. During hands-on workshops, teachers spent time practicing typing and using the program, asking questions and brainstorming how to successfully integrate its use throughout the school day.

Rather than implementing the keyboarding plan throughout the entire school, it was piloted in eight classrooms, two classrooms from grades 1, 2, 3, and 4. Teachers volunteered their classrooms to be the pilot sites. The goal was to address any issues that came up before introducing it to the whole school, all 16 classrooms—four classrooms of grade 1, four classrooms of grade 2, four classrooms of grade 3, and four classrooms of grade 4.

Today, students in all 16 classrooms are using *Type to Learn* as part of their day. Children don't generally ask where certain letters are on the keyboard. They know. All classroom teachers have a *Type to Learn* chart on their wall with student names and checks indicating lessons completed. Teachers manage this school-wide project effectively by setting up schedules so all students have equal computer time.

Type to Learn has a built-in assessment tool. All student lessons are monitored and scored. It is easy for a teacher to look at student scores and see how many lessons they have completed and how many words per minute students are typing. In addition, a teacher can individualize the program to meet the needs of the students.

Another integral aspect to the success of this project is parent involvement. Parent volunteers in classrooms supervise students using *Type to Learn*. They make sure students keep their fingers positioned correctly on the keys and are readily available to answer questions students may have along the way.

An incentive to this school-wide project is our corporate sponsor. Bruegger's Bagel's Bakery in Chelmsford, Massachusetts, sponsors *our Type to Learn* Project. Our business partnership includes the reward of a monthly bagel party to the classroom showing the most *Type to Learn* use. The winning class is praised in our school announcements read over the public address system, and students enjoy complimentary bagels, cream cheese, and orange juice.

General Session: Technology Implementation/Educational Reform

Internet Education for K–12 Science Teachers

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Key Words: **Internet training, K–12, science, West Virginia, mentoring**

The West Virginia K–12 RuralNet Project is a three-year National Science Foundation grant funded project designed to enhance science education through integration of Internet resources. This project is directed through a cooperative effort by the Departments or Curriculum and Instruction at West Virginia University and Marshall University, principle investigator Dr. Randall Wiesenmayer. The goal of the project is to train 1,250 K–12 teachers from across the state of West Virginia to access, navigate, and integrate Internet based resources for use with the new West Virginia state science curriculum framework for thematic science. The training model for this project involves traditional hands-on inservice workshops, online course delivery, and an active multi-tiered online mentoring support system. Over 700 schools in West Virginia will have high-speed direct connections to the Internet, thus making this project transferable statewide and thus serving as a model for schools nationwide. The significance of this statewide connectivity is that teachers can now become effective agents of change through emerging technologies, while enhancing science education throughout West Virginia.

This session will provide background to the WV K–12 RuralNet project, present the philosophical foundations, goals, organizational development, and mileposts in curriculum delivery to date. Presentation of the challenges of delivering a Web-based curriculum to 400 simultaneous users will provide the basis for discussion. Included are the electronic media tools utilized for communications and collaboration, the role and training of online mentors, and the factors for consideration in this format of inservice teacher training. Examples from the online archives will be used to demonstrate the outcomes of this educational process.

Through the experiences of WV K–12 RuralNet we have observed many of the communication difficulties found in distance education. It was hoped, that as a by-product of the project, teachers would establish a "sense of place" in becoming members of a global community and creating a "place for learning" for their students. Although online mentoring helped a great deal in this respect more face-to-face interaction would have been beneficial on a periodic basis to bridge the gaps of the written word. A project of this magnitude has to deal with many variables that can affect the outcome and success of online collaboration. In general, teachers were most supportive of one another as they discussed shared lesson plans and integration of science frameworks and technology. Major stumbling blocks were the lack of connectivity coupled with limited access to the Internet at the workplace. Teachers who had access to the technology and most importantly connectivity at home, were able to complete the assignments and further enhance their skills using the Internet. It should also be noted that it is difficult to serve such a varied population with one single type of participation, in our case a series of online graduate courses. In order to maintain high participation a variety of interaction levels must be allowed for both contribution and consumption. Finally, the mentoring process is extremely important to the success of a project such as this. Carefully selecting mentors to fulfill a clearly defined role, providing them with adequate training and guidelines, and providing them with a long term, consistent support system are paramount.

For those who succeeded in completing the courses there seems to be a sense of accomplishment and an advanced understanding of the medium. These teachers have found a place for the Internet in their classroom and have developed an appreciation for the power of the Internet in their students. These teachers form the backbone of an emerging statewide community of online educators. Further research on the commonalities of this group are underway to assist in determining better recruitment and retention procedures for the future.

This project like many has its disappointments but there is no doubt that it has made its contribution as well as a positive impact to the teaching of science throughout the state.

For more information about the various components of the WV K-12 RuralNet Project, please visit the RuralNet Web site at: http://www.wvu.edu/~ruralnet/

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General Session: Technology Implementation/Educational Reform

Technology Integration in Teacher Education: A Systematic Approach

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Key Words: technology integration, planning models, ISTE, teaching standards

The recent report, Teachers and Technology: Making the Connection, (U.S. Congress, 1995), confirmed that "technology is not central to the teacher preparation experience in most colleges of education. Consequently, most new teachers graduate from teacher preparation institutions with limited knowledge of the ways technology can be used in their professional practice (p. 165)." According to the report, Helping teachers use technology effectively may be the most important step to assuring that current and future investments in technology are realized (p. 2). How, though, can we best prepare teachers to develop the skills needed to incorporate a variety of technology tools in their professional practice? Most leaders in the field agree that this cannot be accomplished by educational technology classes alone. In addition to specialized courses in educational computing and technology, preservice teachers should experience widespread integration of technology into "non-technology" classes and field experiences. Systematic approaches to achieving this type of technology integration, however, have been lacking.

This session will describe efforts being made at two colleges of education to systematically address the needs cited above. Specifically, it will focus on a planning model and supporting materials that address the minimal standards for technology use, established by the International Society for Technology in Education (ISTE), that all teachers should meet. The model provides a structure for helping university faculty select where each of the standards could appropriately be applied in particular courses, identify technology tools that could be modeled by faculty in their own instruction, and specify software that would help preservice teachers plan lessons for their future classrooms. A key assumption of these materials is that the ISTE standards should be addressed in a systematic way that requires structured planning across courses and specialty areas. Two of the presenters of the session have recently co-authored an article (Handler & Strudler, in press) that describes this framework, materials, and strategies for their use. In addition to providing an overview of that material, the session will address efforts at implementing the model at our respective universities during the 1996–97 academic year. The framework and planning materials will be shared and suggestions for future use will be offered.

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Workshop

Save the Trees With the Paperless School and Classroom: Meeting the Goals of Technology and Networks in Our School Systems With Inter-School E-Mail

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Key Words: **paperless communication, e-mail, network**

The basic goals of technology in education are: (1) To enhance learning; (2) To improve communications; and (3) To improve productivity. The above statement is true for most school systems across the country. Millions of dollars are now being spent on networks, hardware and software to accomplish these goals of technology in education. It is vital that, as educators, we utilize the technology in creative and productive ways in improving our curriculum.

Itinerary of Workshop

Section:	Presenter:	Time:
Introduction of workshop	John Strycker—High School Rep.	10 Min.
Hardware requirements and options	Brian Fuller—School Technician	15 Min.
Software requirements and options	Phil Richason—Jr. High Rep.	15 Min.
Classroom Use of E-Mail	John Strycker—High School Rep.	30 Min. Group Work Portfolio H. S. Homepage with staff & students Daily Assignments

Inter-Corporation E-Mail	Ron Snapp—Curriculum Director	20 Min. Local Area Wide Area Community
Hands-on Activity	Group	90 Min. Classroom Assimilation School Assimilation

With this particular layout, the participants will get a complete understanding of how e-mail could be utilized in a school system meeting district visions and goals. This workshop will also accommodate a broad audience because the presentation team is made up of Central Office Personnel, High School, and Junior High Teachers/Coordinators, and a corporation technician. Everything presented in the first half of the presentation will come together in the "Hands-on Activity" demonstrating the impact e-mail can have on the classroom and the corporation. In addition, our corporation will have the potential of saving over $15,000 in paper alone this school year. We anticipate saving many trees this year.

Paper Session

Integration of Internet Resources Into a First-Year Researched Composition Course

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Key Words: **Internet research, researched composition, World Wide Web, electronic mail, electronic bulletin boards**

Abstract

Youngstown State University is currently integrating Internet research tools into *English 551: Composition II*, a required first-year course that teaches students how to write researched, argumentative papers. Four pilot sections were team-taught by faculty from English and CS&IS. This paper describes the structure of those pilot sections, the conclusions reached, and the recommendations made for those considering similar courses, in terms of Internet tools, course structure, and teaching methods.

1. The English 551 Project at YSU

English 551: Composition II is part of a sequence of writing courses required for all first-year students at Youngstown State University. Its goal is to teach students how to write *researched argumentative* essays, which means that a main objective is to teach *research skills* (generally involving library resources). All sections of the course include short writing exercises and a substantial final paper presenting a well-researched argument on a controversial topic.

Youngstown State University is currently integrating *Internet research tools* into all sections of *Composition II*. This project involves both the English and Computer Science & Information Systems (CS&IS) departments, and has the support of the Dean of Arts & Sciences. Four pilot sections of the course were taught during the 1996 Winter and Spring quarters. Each was team-taught by two faculty, one from the English Department and one from the CS&IS Department, who shared all duties of the course, including syllabus and assignment design, lectures, individual conferences, and grading. Surveys and short written evaluations given at the end of the Spring quarter allowed students to provide feedback.

In this paper I relate my experiences in teaching two of the four pilot sections (with two different English faculty). This includes advantages of and recommendations for teaching Internet skills in this context, and how both the students and I benefited from the experience.

1.1 Rationale

The world-wide system of computer networks known as the Internet is one of the largest and fastest-growing sources of research information. The World Wide Web provides quick access to data stored on the millions of computers it connects, and electronic mail and bulletin boards give access to the millions of people who use it. It is widely recognized that the ability to find and evaluate information on the Internet will be a necessary skill for students in the years ahead.

The teaching of such skills is the responsibility of the Computer Science department at most colleges (including YSU), often as part of a Computer Literacy course. We argue that Internet research skills are more effectively taught as part of a general course on performing research (such as *Composition II*). This allows students to see those skills in the larger context of other research methods (such as the traditional library), and to immediately apply them to substantial research projects. This would motivate students to learn those tools, and aid in their long-term retention of that knowledge.

2. Course Structure of the Pilot Sections

YSU is on a quarter system, so courses are typically taught 4 hours a week over 10 weeks. These sections were taught 2 hours a week in a classroom and 2 hours a week in a PC-based computer lab (equipped with Microsoft Office and Netscape Navigator 2.0).

We avoided using a standardized syllabus in order to experiment with different ways of teaching the course. However, all sections covered the following topics:

- Basic strategies for doing research
- Paraphrasing and documenting sources
- Analyzing argument styles and fallacies
- Organizing and outlining research papers
- Library orientation (including electronic library databases)
- **The World Wide Web and Web search tools**
- **Electronic mail**
- **Electronic bulletin boards** (at least an introduction)

Each section also had the following common assignments:

- An initial essay (3–4 pages) presenting an argument on some controversial topic.
- A second essay (3–4 pages) analyzing and comparing the argument styles of two papers on the same topic (one from the library and one from the Internet).
- A final paper (8–10 pages) presenting a *researched* (at least 5 sources) argument on some controversial topic.

A sample course outline (for Spring 1996) is given in Figure 1.

Wk.	Classroom Topics	Lab Topics	Assignments
1	introduction	word processing	in-class essay
2	paraphrasing, summarizing sources	hypertext, the World Wide Web	paper 1 assigned
3	choosing topics, research strategies	Web search tools, work on paper 1	rough draft of paper 1 due
4	argument styles and fallacies	library orientation	paper 1 due, 2 assigned
5	*individual conferences*		
6	documentation and source evaluation	electronic mail, work on paper 2	rough draft of paper 2 due
7	outlining and note taking	electronic newsgroups	paper 2 due
8	outline conferences, peer reviews	posting to newsgroups	first draft of final paper due
9	*individual conferences*		
10	final in-class essays	work on final paper	final paper due

Figure 1. Sample course outline

3. General Notes and Recommendations

Teaching Internet skills in this course was *very* different from teaching them in a Computer Literacy course. Students in a course like *Composition II* must go beyond simply learning to *use* these tools (as is usually required in a computer literacy course); they will have to become comfortable enough with them to *apply* them to their research. That is, use of these tools must become "second nature" to the students, allowing them to concentrate on *research* problems rather than on problems using the computer. This is a particularly difficult step for students with little or no computer background (Russell, 1995), one that requires more time and practice than in a typical literacy course.

Specific recommendations to this end:

- **Minimize the number of Internet topics covered**. While it is tempting to include as many sources of information as possible (list servers, Archie, ftp, gopher, etc.), it is better to cover a few tools in depth. Also keep in mind that students will be simultaneously learning about many more topics related to composition. Even though we only covered three major Internet tools, some students still felt overloaded.
- **Leave lab time for individual research and writing**. Letting students use these tools for their research during class, where help was available from the instructors, was a far more productive use of time than learning another software package would have been. Even though we scheduled some free time for each paper, many students would have traded learning about electronic mail or newsgroups for still more time.
- **Schedule individual conferences with students**. Two weeks of classes were replaced with individual 15–30 minute sessions with students. This is standard practice in many composition courses, letting students discuss specific research problems they are having. This is also a very effective way to teach computer skills (Romiszowski and de Hass, 1989); not only was I able to help students with the *mechanics* of those tools, but I was also able to give advice about their *application* to specific research problems (such as keywords to use in a Web search, or newsgroups to read).

- **Base the grade on writing, not on use of Internet tools.** We gave several short assignments (similar to those typically given in a Computer Literacy course) meant to exercise their skills in Web search, electronic mailing, and posting to newsgroups. Some students complained that this took time away from their writing, a legitimate complaint for a Composition course. If given, such assignments should be as simple as possible, and students should use their papers to demonstrate their mastery of the research tools.
- **Emphasize library resources.** The traditional library will still be the main resource for student research, so students must be at least as proficient in using it as they are the Internet. A week was spent dealing with the library rather than the Internet (including a "library tour" and an introduction to the library's electronic resources).

In general, simply keep in mind that **the main goal of such a course is to teach students how to write research papers; Internet tools are only one means towards this end**. The Internet aspect of the course should only be used to supplement the composition aspects; it should not overshadow them. Otherwise, students can feel as if they are taking two separate courses (a complaint from some students the first time the course was taught).

4. Notes on Specific Internet Tools

4.1. The World Wide Web

The World Wide Web was by far the most useful tools for research. Almost all students referenced at least one Web site in their final paper, and most found it informative and easy to use:

How useful was it in this course?				
none				very
1	2	3	4	5
0%	5%	27.5%	47.5%	20%

Do you think it will be useful in the future?				
no				very
1	2	3	4	5
0%	5%	15%	47.5%	32.5%

How easy was it to learn?				
easy				hard
1	2	3	4	5
40%	40%	17.5%	2.5%	0%

The Web was easily covered in two or three lab sessions:

1. Students were shown a course home page (*http://cis.ysu.edu/~john/english.html*) containing hypertext syllabi and calendars, and were instructed to check it regularly for assignments and schedule changes.
2. Students were taught about URL addresses and were shown how to open a given URL in Netscape.
3. Students were introduced to the wide variety of information available on the Web through a page containing a large number of useful links organized by category (Yahoo (*www.yahoo.com*) is a good site for this, or see (*http://cis.ysu.edu/~john/web.html*). They were then given time to explore sites they found interesting.

4. Students were introduced to search engines available on the Web, including InfoSeek, Webcrawler, and Alta Vista. The concepts behind them were explained in detail, and students were encouraged to spend time trying different searches.

4.1.1. Recommendations: Teaching the World Wide Web

Effective use of the search engines is difficult to teach. Students tended to treat them as if they were magic, expecting them to find exactly what was needed for their papers regardless of what keywords were used, and often became frustrated if nothing (or worse, too many things!) were found. The following ideas must be strongly emphasized:

- **Different keywords produce vastly different results.** Try as many as possible to find all relevant references.
- **Avoid choosing overly general or specific keywords.** If no results are found, use fewer or less specific keywords; if too many results are found, use additional or more specific keywords.
- **Become familiar with the syntax of the search engine.** A good example of this is the "+" symbol that many use for "and"; students who did not know this were surprised when *adding* keywords in some engines produced *more* results instead of fewer.
- **Different search engines can produce vastly different results.** Try as many as possible when doing research.

These points are particularly relevant in a research course like *Composition II*, where proper use of the search engines is vital. Unlike a library, there is no "reference librarian" on the Web; search engines are the only way to find information on a *particular* subject. These points can be emphasized through examples (either in lab or an assignment), in which students input the same keyword to different search engines, slightly different combinations of keywords to the same search engine, etc.

4.2. Electronic Bulletin Boards

Electronic bulletin boards can be a very useful resource for students, allowing them to interact with other people who have an interest in their research topic. Unfortunately, they can also be very frustrating if no appropriate newsgroup exists for their topic, making electronic bulletin boards a "feast or famine" prospect. This was reflected in our survey, where the perception of usefulness greatly varied:

How useful was it in this course?				
none				very
1	2	3	4	5
17.5%	30%	25%	17.5%	10%

Do you think it will be useful in the future?				
no				very
1	2	3	4	5
22.5%	20%	15%	30%	12.5%

How easy was it to learn?				
easy				hard
1	2	3	4	5
17.5%	40%	30%	17.5%	5%

Students were required to **find a newsgroup appropriate to their research topic, and to post either their thesis statement or a relevant question to that group**. When students could find such a group, the replies they received were *very* useful—some incorporated those replies into their final papers, either as additional arguments for their position, or as possible objections which they developed counterarguments to. Some students were also referred to other sources of information (books or journals related to their topic). One student actually changed her position on her topic because of replies she received to her initial post.

Unfortunately, not all students were able to find newsgroups relevant to their research. Unlike the World Wide Web, where millions of sites cover almost every topic, there are only a few thousand newsgroups. In addition, the level of discussion on many groups is either too high-level for first-year students (true of many *sci.* groups), or too low-level (i.e., "flaming") to be useful.

Students also found bulletin board tools very difficult to use. This was mostly due to the sheer number of topics involved, including finding appropriate newsgroups (search tools for bulletin boards are generally much less powerful than those for the Web), exploring threads to find useful articles, and posting and replying to articles (which also requires an understanding of electronic mail). It took two full weeks to teach all of this, which was an additional source of frustration for students who did not find anything relevant to their research, as from their point of view that time had been wasted.

4.2.1. Recommendations: Teaching Electronic Bulletin Boards

If this much class time is to be invested in electronic bulletin boards, *all* of the students should get some use from them. This may mean **limiting allowable research topics to those for which an appropriate newsgroup exists**, and providing students with that list early in the course (Davis, 1995).

It must also be emphasized that **newsgroups are more general than Web sites**. If a student cannot find a group specifically related to their research, they need to look for more general topics that their research would fall under. For example, there is no newsgroup dedicated solely to "steroids"; however, steroids are related to several more general topics, such as medicine, chemistry, drugs, and sports, which do have newsgroups.

Finally, students must realize that they will usually not get useful information by just "lurking" in a group. The only way to take full advantage of the knowledge available in a newsgroup is to **post a question or request**.

4.3. Electronic Mail

Electronic mail was very easy to teach, mainly because it did not involve any kind of searching (as the Web and newsgroups do). We were able to cover it in two lab sessions.

How useful was it in this course?				
none				very
1	2	3	4	5
5%	35%	35%	15%	10%

Do you think it will be useful in the future?				
no				very
1	2	3	4	5
0%	20%	30%	20%	30%

How easy was it to learn?				
easy				hard
1	2	3	4	5
45%	25%	25%	5%	0%

Unfortunately, electronic mail was also the least useful skill for this course. While it is important for communication (probably why students thought it would be more useful in the future), its only real use for research is to send specific questions to authorities in their area (that is, to perform an "electronic interview"). To do this, however, students need to know who those authorities are as well as their e-mail addresses. Only one student was able to send electronic mail to an authority in his field; he never received a reply.

Electronic mail was more useful in the context of electronic bulletin boards, as many of the replies that students received to their posts were mailed to them (instead of posted to the newsgroup). The only other use students had for it was to communicate with us, which was not really related to research.

4.3.1. Recommendations: Teaching Electronic Mail

While electronic mail is easily taught, it is only useful for a course like this in the following circumstances:

- **Electronic newsgroups are also covered**, and students post messages or requests which may be answered through electronic mail.
- **Addresses of authorities (who are willing to reply to questions they receive) are provided to students**. One possibility is to involve other faculty at the college (something we are considering at YSU), who would agree to answer questions through electronic mail. However, this would limit allowable research topics to the interests of those participating faculty.

5. Additional Advantages

As stated earlier, the main advantage of teaching Internet skills in a course like *Composition II* is the direct application of those skills to research projects. There are other advantages, however, due to the course's focus on general research methods.

5.1. Integrating Internet and Library Resources

On the surface, the "traditional library" seems very different from the Internet. The underlying research methods, are very similar, however, particularly in the modern computer-based library. We found it possible to *integrate* instruction about library resources and Internet resources, increasing student understanding of both.

Most modern libraries keep resources such as card catalogues, journal abstracts, newspaper articles, government documents, etc. *online* in some form. Many also have access to statewide or nationwide databases of articles and abstracts. For example, institutions in Ohio have access to OhioLINK (Dykhuis, 1995), which includes electronic databases of newspaper articles and journal abstracts, in general areas as well as specialized areas such as science, business, medicine, education, etc. Like the World Wide Web, most of the information in these databases is found through *keyword search*. Once students have mastered important concepts of this kind of search (as described in section 4.4.1), it is easy to effectively use these library resources in the same way.

If possible, these electronic library resources should be available to students through the World Wide Web. This is the case at YSU, where Maag library maintains their own home page, allowing students to access OhioLINK directly through their site. This made it possible for students to search for both Internet and library sources without leaving the computer lab, and made it much easier for us to instruct students in the use of OhioLINK.

5.2. Evaluation and Documentation of Sources

Evaluation of sources is a major concern for students doing research on the Internet (McGlinn, 1995). Unlike a library, where books, journals, and newspaper articles undergo some editorial process, there is virtually no control over the contents of Web sites or newsgroup postings. Students must judge for themselves the validity of what they find, distinguishing between fact and opinion. Fortunately, this subject is usually covered in depth in a research course like *Composition II*, where students learn to routinely judge the worth of a source before referencing it in their papers.

Students were instructed to evaluate the *reputation and qualifications* of the person or group authoring a site or post, its *purpose* (reporting facts, stating opinion, or advertisement), and the *argumentative style* (including any fallacies) of the writing. They were also told to consider the possibility of forgery, and to note the address of the site or poster to help confirm its validity.

Students were also required to note the address of any site or author they found useful, in order to properly *document* those sources in their papers (Guernsey, 1996). This emphasis also made students much more aware of the nature of URL and e-mail addresses than I have seen in any Computer Literacy course that I have taught.

6. Student Reaction to the Course

The pilot sections of *Composition II* were not advertised as "computer intensive" in order to get a good cross section of the student body (i.e., to keep "computerphobic" students from avoiding them). A survey of student background for the Spring quarter showed the following:

Describe your knowledge of computers before this class:				
none				a lot
1	2	3	4	5
45%	10%	40%	5%	0%

While this lack of knowledge intimidated some students at first, most quickly learned to utilize the Internet for their research. Almost all remarked favorably about using the Internet in their final evaluations:

- "When I found out this class was computer-aided, I was a little scared, because, I'm basically computer illiterate. But after a few days I felt comfortable working on the computer and I began to discover new and interesting things that I didn't know could be done."
- "I think more English classes should be combined with computers—especially 551 because of all the research."
- "Before this quarter I had no idea how to use half of the resources other people use day to day.... Hopefully, English 551 will be taught this way well into the future."
- "I think learning as much as I did about the computer will greatly help out in the future with papers, and that is the point of English 551, isn't it?"
- "Combining computer technology and research methods was very effective in this course. I obtained some very important sources for my paper through the Internet, which I had no idea how to use until this course."

In our survey, 75% of the students thought that Internet tools were better taught as part of a composition course rather than as a separate CS&IS course. The most important measure of the success of this course was the research papers themselves, however. Every student included at least one Web site and/or newsgroup posting as a reference, showing that they had indeed learned to use the Internet as a research resource.

7. Involvement of and Benefits to Computer Science Faculty

Any institution considering the integration of the Internet into a course like *Composition II* should fully involve Computer Science faculty. These faculty should be involved in *all* aspects of any pilot sections, including syllabus and assignment development, lectures, individual conferences, and grading of papers. This is the only way to judge exactly how Internet tools fit into the context of such a course, determining both *what* and *how* students need to be taught. Our surveys showed that students also greatly appreciated the collaborative nature of the course, receiving instruction from both English and CS&IS faculty.

I believe that Computer Science faculty involved with such courses will also benefit greatly. The experience gave me an entirely new viewpoint on teaching computer skills, one based on their *application* rather than just the skills themselves. I was also exposed to teaching techniques standard to many composition courses, such as portfolios, individual conferences, peer review, brainstorming, and writing across the curriculum, which I intend to integrate into my own classes. I strongly recommend this type of experience to all Computer Science faculty.

Acknowledgments

I wish to thank the other faculty involved with the pilot sections (Kelly Belanger, Julia Gergits, Mary Lou Henneman, and Bob Hogue) for their roles in developing and teaching these sections, and for feedback about this paper. I also wish to thank Dean Barbara Brothers, who got the whole thing started.

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Paper Session

Hypermedia Support for Response-Based Literature Teaching and Learning

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Key Words: **hypermedia environments, student response, literature education, hypermedia design, K–12 education, computers and classroom culture**

Abstract

This paper reports on the Multimedia and Literature Teaching and Learning project which investigated the use of hypermedia to enhance response-based literature teaching and learning. It included a critical survey of commercial offerings from a response-based perspective, and the consequent development and testing of hypermedia prototypes for elementary and secondary/post-secondary usage. Findings suggest ways hypermedia can uniquely support response-based pedagogical approaches, given complementary epistemological, instructional, and technological environments.

The *Multimedia and Literature Teaching and Learning* project was initiated to explore the potential of multimedia and hypermedia for supporting response-based literature teaching and learning. Response-based approaches regard readers as active meaning makers whose personal experiences affect their interpretations of literary works (Bleich, 1978; Tompkins, 1980). Response-based practice likewise emphasizes the constructive reading process (Langer, 1993). There are many reasons to believe hypermedia might support such practice. Indeed, many contemporary scholars believe it is ideally suited to do so (Bolter, 1991; Landow, 1992). These notions, however, need to be systematically explored. The project was concerned with doing just that.

Critical Review of Commercial Applications

The first phase of the *Multimedia and Literature Teaching and Learning* project was concerned with reviewing commercial software from a response-based perspective. Criteria and procedures were developed for analyzing the content of hypermedia literature applications in terms of its inherent capacity to represent and support response-based pedagogies. Eight evaluative categories in three groupings were established through a series of focus group sessions (Swan and Meskill, 1995).

Technical concerns (content clarity, technical quality, use of technology) dealt with the general quality of the programs irrespective of their response-based considerations; **response-based considerations** (what counts as knowledge?, the role of the text, the role of the student, the role of the teacher) were concerned with whether the formal aspects of hypermedia literature applications presented literary works in ways that might support response-based pedagogies; and **classroom issues** considered how the applications might be used in regular classroom settings. Evaluations within each category were essentially narrative in form but included ratings on a 10-point scale for comparative purposes. Within this framework, reviewers were asked to answer specific questions and look for particular kinds of features in each of the evaluative categories.

Evaluators were also asked to isolate specific features and hypermedia tools that might support response-based teaching and learning. These were reduced to 11 general features that might reinforce response-based pedagogies (Meskill and Swan, 1995). They include: transparent navigation, intertextuality and juxtaposition, the facility to share responses, the facility to support non-text responses, the facility to make links, support for envisionment, access to multiple perspectives, support for discourse, promotion of student ownership, presentation of background knowledge, and the facility to explore the author's craft.

Applications to review were identified through a detailed search of listings dedicated to hypermedia materials. Fifty-four hypermedia literature programs were identified, and 45 were acquired and reviewed by 25 graduate students of education. Findings from the review revealed that commercial hypermedia literature applications were technically quite good, moderately priced, designed for commonly available platforms, and related to works commonly taught in elementary and high school classrooms. They did not, however, embody response-based pedagogies. In particular, average ratings on response-based criteria for the applications we reviewed were 4.69 (on a scale of 1 to 10), while the same software packages averaged 7.26 on technical criteria relating to hypermedia design.

If one considers programs with ratings of 4 or below as "poor," those with ratings of 5 to 7 as "adequate," and those with ratings of 8 or better as "good to excellent" with respect to such criteria, fully 23 of the 45 programs we reviewed were rated as "poor," and only 5 were considered "good to excellent" from a response-based perspective. On the other hand, from a technical point of view, only 5 applications were considered "poor," while 22 were rated as "good" to "excellent." Tables 1 and 2 graphically summarize these comparisons.

Table 1
Ratings on Technical Concerns

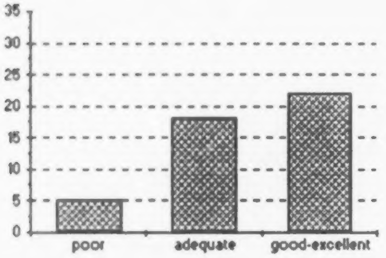
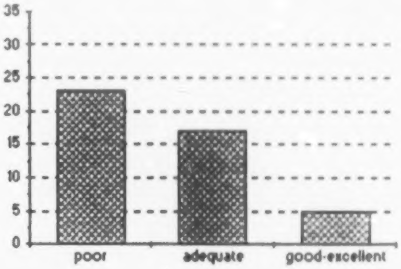


Table 2
Ratings on Response-Based Criteria



In terms of response-based features, only two—transparent navigation and intertextuality and juxtaposition—were found in more than half the software packages reviewed. Fully five of the features identified as supportive of response-based teaching and learning—the facility to share responses, the facility to support non-text responses, support for envisionment, access to multiple perspectives, and the promotion of student ownership—were found in less than a quarter of them. A sixth feature—support for discourse—was found, if at all, as an offline, rather than an online, feature.

Indeed, the pedagogical approaches taken by the vast majority of the commercial applications we reviewed mirrored the approaches commonly found in schools. At the elementary level, literature teaching and learning was equated with reading instruction. At the secondary/post-secondary level, it was almost exclusively text-centered. What was sorely missing in most of this software was any provision for constructive roles for learners. In the next phases of the *Multimedia and Literature Teaching and Learning* project, we set out, therefore, to design and test programs to address this shortcoming. Based on the strengths, weaknesses, and potentiality found in commercial products, two prototype applications, *Kidspace*, for elementary students, and *the BEATS*, for secondary/post-secondary students, were designed and pilot-tested in actual classroom settings.

Kidspace

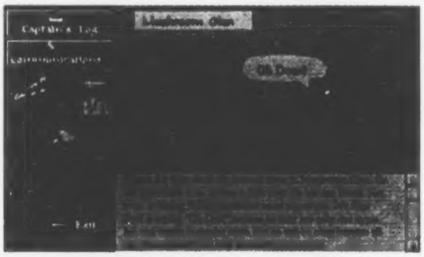
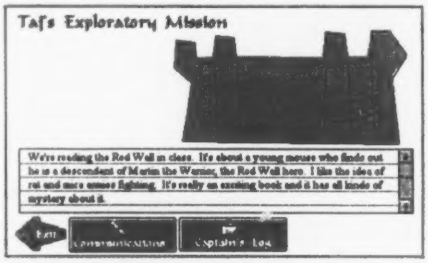


Figure 1. Mushroom Glen in "Cricket Village"

Kidspace (Meskill and Swan, 1996) was designed for students in grades one through six around the metaphor of a universe populated by individual students' worlds. Each world supports a variety of spaces in which students are encouraged to recursively construct, explore, write, reflect, and otherwise express their feelings about their own and others' work. "Cricket Village" (Figure 1) and the "Exploratory Mission" (Figure 2) are personal constructive spaces; "Communications" and the "Captain's Log" are public and private reflective spaces. Students can "visit" each other's worlds as readers, but they can only author in their own.


Taf's Exploratory Mission

We're reading the Red Wall in class. It's about a young mouse who finds out he is a descendent of Martin the Warrior, the Red Wall hero. I like the idea of rat and mice armies fighting. It's really an exciting book and it has all kinds of mystery about it.

Figure 2. "Exploratory Mission" page

Kidspace was designed to instantiate response-based criteria concerning knowledge, text, students, and teachers. Indeed, all features identified as supporting student responses to literature can be found somewhere in *Kidspace*. The goal was for students to use it as a thinking, construction, and communications tool. We looked to teachers to integrate its use with offline reading and reading activities. In piloting the prototype in classrooms, we were interested in seeing whether students and teachers naturally engaged in these activities in the ways we had envisioned.

Six elementary classes participated in the piloting of *Kidspace*. Students and classes were chosen to reflect varying grade levels, student populations, and learning environments from among volunteers who shared a common whole language approach to reading instruction and previous classroom experience with computers. Four classes—two each from an urban Montessori school (a combined 1-2 and a combined 3-4) and a suburban elementary school (a 2-3 and a 5th grade)—participated in the project over a two month period in the spring of 1995. Because serious technical problems surfaced during this first trial, *Kidspace* was reworked and briefly tested in two additional classrooms (a 3-4 and a 5-6) in a private rural elementary school in the spring of 1996.

In the first study, we collected student artifacts and both observational and attitudinal data. In the second study, only student artifacts and observational data were collected.

Although technical difficulties limited findings from the pilot study, we were still able to learn a great deal. Students in all classrooms were uniformly motivated by *Kidspace*. This is evident in teachers' logs, observations, the videotapes, and students' statements. In all classrooms, "Cricket Village" was the most popular *Kidspace* space. The most interesting findings, however, involved the relationship between classroom contexts and efficacy. In particular, teacher perceptions of the *Kidspace* activities differed in terms of how those activities were conceptualized and so instantiated. Teacher perceptions, in turn, appeared related to epistemological beliefs and attitudes inherent in the differing cultures of the participating schools.

The learning environment in the Montessori classrooms appeared to be most in keeping with how we envisioned *Kidspace* being integrated to best effect. In both Montessori classrooms, *Kidspace* was perceived as one kind of material among many which students could manipulate in constructing their own understandings of the literary experience. Students in these classes collaborated easily with each other on computer, and frequently called their teachers and other students over to share their work with them. Montessori students were also more likely to explore each others' work, and frequently used the "Communications" space to write comments about it.

In contrast, students in the more traditional suburban classes, whether or not paired at the computer, tended to work individually, and an effort was made to keep them isolated from the rest of the class. Accordingly, students in these classes were less likely to become involved with each others' work. Teachers, in these classes, tended to view the computer as an instrument of instruction, much like a workbook or a traditional text. What students did in *Kidspace* was perceived more as a result of the software than of the individual child's thinking.

All in all, then, the classroom cultures shared by teachers and students in the Montessori classes seemed more supportive of the intended use of *Kidspace* than the cultures of their suburban counterparts. Interestingly, however, teacher perceptions concerning the role of computers shared a striking similarity across classes. In both, work on the computer was consistently cast as separate from other classroom activities, and not incorporated and valued as part of a larger reading and writing program. While this surely was at least partially an affect of the experimental nature of our pilot, it seems also to have resulted from a common belief that computer-based learning is somehow self-contained and "instructional." This is most evident in the under-utilization of the "Exploratory Mission" space in both schools.

Rural classes fell somewhere between the others. In terms of classroom environment, they were, if anything, more child-centered than the Montessori classrooms. Both classes were small and project-oriented. In terms of epistemology, these classes were somewhat more traditional than the Montessori classes, and somewhat more constructivist than the suburban classes. In addition, use of *Kidspace* was relegated to mornings when the "computer teacher" was available. The computer teacher, however, was one of the authors, and thus able to direct students' use of *Kidspace* to response-based activities. Although the pilot in this school lasted only two weeks, it showed that students could use the application to explore their literary experiences in interesting ways.

Indeed, given encouragement, most students in these classes enthusiastically used the "Exploratory Mission" space as intended:

> *Lately, I have been reading a series of books. One of them is called* Dunc and the Flaming Ghost. *It is really funny. In fact the whole series is very funny. It's about two kids who solve mysteries. One kid, Dunc, is very neat and usually gets them involved with the mysteries. The other, Amos, is a disaster waiting to happen. Everything he does winds him up in the hospital. Especially answering the phone....*
>
> *I am reading a Hardy Boys book called* The Tower Treasure. *What's happened so far is that the Hardy boys were run off the road on their motorcycles by a crazy driver, and their friend Chet's car got stolen. I have no idea what's going to happen and that's what I like about Hardy boys books—they're exciting mysteries! This is my second one and I am really looking forward to it....*

> *I'm reading* Dealing With Dragons. *It's about a stubborn princess that likes living with dragons and doesn't want to get rescued. It's very funny. She's meeting with a witch right now and learning spells. When she was little, she learned fencing, cooking, Latin, and philosophy....*

It is interesting to note that most students chose to write about books they were in the process of reading. Given more time, this phenomenon could perhaps be capitalized on to explore the reading experience in greater depth. Many students also illustrated their writings, and all chose fonts and colors to match their feelings about their readings. Their responses suggest that *Kidspace* can be used very effectively to support young children's reflection on reading experiences, given teacher direction and encouragement. The latter, however, is perhaps the greatest stumbling block for teaching professionals and one that must be addressed before applications like *Kidspace* can be used to their full advantage.

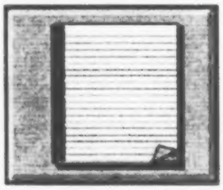
the BEATS

the BEATS
works
I AM WAITING
Ferlinghetti

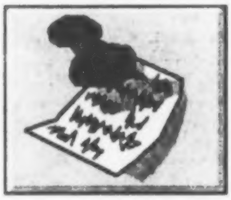
Figure 3. "I Am Waiting" by Lawrence Ferlinghetti

the BEATS (Meskill and Swan, 1997) focuses on the works of the Beat writers and is designed to incorporate a *Rhino* collection of audio CDs. Central to it are the works themselves (Figure 3). In many cases, the user can choose to hear a work read by its author, and most pages also contain illustrations and/or animations. In addition, linked to every work is a discourse area, where students and teachers can leave general comments and/or questions, and a variety of background information presented in words, pictures, and sounds. *the BEATS* contains a biography for every author represented and descriptions of many of the places that figured prominently in the history of the Beat movement. The program also contains period newspaper articles and radio interviews, musical selections, photos, and a glossary of beat terms.

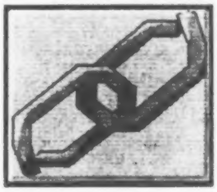
Most importantly, *the BEATS* contains a set of response-based tools specifically developed to support response-based teaching and learning in ways we hoped would make the best use of the unique characteristics of the computing medium. In particular, we thought they might support student discourse by making reticent students' voices heard, by encouraging more reflective conversations, by freeing discourse from time constraints, by providing concrete representations of conversations, and by providing concrete links to text. The tools are of four types:



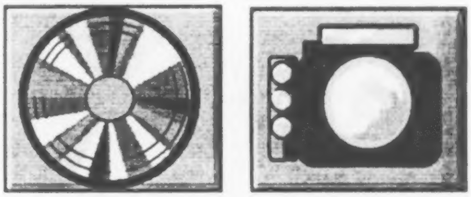
The **Personal Notes Tool** allows students to link the literary texts found in *the BEATS* to writings in a personal journal. It links every page in the main program to a similarly numbered page in each student's own "private journal" which can be accessed through the main program or separately. All pages in the journal can be copied and/or printed.



The **Notes Tool** allows students to drop buttons in the margins of a page in *the BEATS* to annotate text. These buttons popup scrolling text fields which anyone can read and/or write in. Notes is a tool designed to support public discourse about particular elements of literary works. The spaces it creates hold reflective conversations among students and teachers related to specific text.



The **Links Tool** supports student creation of hyperlinks between any of the pages in *the BEATS* by allowing them to create named linking buttons and to place them in the margins of the texts. Links is a tool designed to provide concrete representations for relationships students discover within and between texts.



Media Tools allow students to link photographs and audio clips to text. Clicking on the **photography tool** allows students to choose from over 100 photographs related to the readings. The **audio tool** similarly lets students select and play audio clips from the three audio CDs it incorporates.

Twenty-six undergraduates enrolled in a creative writing course at an upstate NY community college participated in piloting *the BEATS*. Their instructor generally adopted response-based approaches in conducting his classes and worked to model and support effective modes of literary discourse. Typical classroom discussions focused on the forms and functions of poetry, historical contexts, and students' aesthetic and critical responses to texts. With 26 students, however, opportunities to join whole class discussions were limited.

The pilot study took place over the course of five regularly scheduled class periods. After an initial orientation, students used *the BEATS* for two 50-minute class sessions separated and followed by whole class discussion sessions (50 minutes). Each online and corresponding offline class was observed, all participating students and the instructor were interviewed at the close of the study, and questionnaires concerning their reactions to the entire process were completed by 17 of the 26 students.

Both the instructor's and the students' responses to *the BEATS* were extremely positive. Both believed its response-based tools offered a unique and interesting environment in which to explore literature. In contrast to our initial *Kidspace* pilots, *the BEATS* was thoughtfully integrated into an existing curricular stream. Data collected from the pilot study suggest that students' online responses were both quantitatively and qualitatively different from their regular classroom responses. Students' online responses not only mirrored the instructor's linking of form and function, but went further in personalizing those links. Although the pilot was limited in scope by the availability of computers, good evidence for the capability of response-based programs like *the BEATS* to support similar pedagogies was obtained.

Making reticent voices heard. During regular class discussions of the selections, only eight of the 26 students ever actively participated, whereas every student wrote online responses to each of the selections. Similarly, only one student's poem was discussed during the regular class period whereas all students had the opportunity to give and receive comments on each others' poems online.

Encouraging reflection. The instructor thought that student exchanges were reflective and believed they would have been even more so had there been more time for them to work on the computers. Students interviewed stated they could "write [their] first thoughts, read the poem again, and go back and see things [they] didn't see before." They also thought that being privy to a fuller range of perspectives encouraged a more reflective attitude.

Freeing discourse from time constraints. Because, in this pilot, students had very limited access to computers, the program did not free discourse from time constraints at all. When interviewed, students lamented the limited amount of time they had been able to work with *the BEATS*, consistently stating they would have liked to have had the time to develop extended online conversations.

Providing concrete representations of literary conversations. There is good evidence that students began to use the tools in *the BEATS* conversationally, for example:

> *I like how Ginsberg wrote as if he were having a conversation with America. The repeating of "America" at the beginning of the lines gave the poem interesting rhyme. I like how he continuously changed his feelings yet stayed within the same thought and mood. I also thought listening to him read his poem on the CD made it easier to understand his feelings.*
>
> *I agree with the liking of the repeating of "America." I feel it adds to the poem. I also feel that Ginsberg is very angry with America and our way of life. The poem also had an air of intoxication, like someone who had been drinking and their anger was coming out. Maybe hearing it made me feel that it was meant to be felt that the person was drinking.*
>
> *I agree with you on a lot of the points you bring up. I think that this is an angry poem, and that he is just speaking to someone. I liked it overall.*

Students interviewed stated that it was helpful to "see what other students were thinking" and that this opportunity opened up whole new perspectives for them. The instructor capitalized on this process by printing out and distributing comments to be reviewed and expanded on in class. This integration of modes seems perhaps the best use that can be made of response-based tools, in that it maximizes the advantages of both online and regular classroom discourse.

Providing concrete links to texts. Having comments immediately linked to the poems appeared to make the connection more concrete and tangible to students:

> *Ginsberg uses a lot of rhetorical questions in this poem. He asks America when this is going to happen or that is going to happen, and sometimes the questions are ridiculous but have truth: "America, when can I go to the store and buy what I need with my good looks?"*
>
> *The line "I am waiting for the last supper to be served again" has great pull as well as the line "I am waiting for my number to be called."*

Indeed, the instructor felt that the juxtaposing of responses to text resulted in important connections between the two—"in [the students'] heads." Students interviewed stated that they liked being able to write "in the margins" because it made their thoughts seem "right there," and "fresh."

Because of the limited time available for using *the BEATS* in this pilot, students were neither given assignments using the *Links* and/or *Media* tools, nor time to use them on their own. It is therefore difficult to assess what the use of such tools might have added to student experiences. Nonetheless, many students used the discourse pages to connect their responses to multiple poems in *the BEATS*:

> *Like Ginsberg in America, Ferlinghetti uses repetition as his favorite tool for this poem. Over and over, he repeats "I am waiting, I am waiting" and then he goes on, at the end of his idea to tell what he is waiting for—"the rebirth of wonder…."*
>
> *I really liked this poem more than any of the others. It was very easy to follow and understand. Although some of the things that he was or is waiting for seem very unrealistic, still it makes you think. I also like the chanting. Like in America by Ginsberg, it really makes the poem flow and kept me wanting to read more to find out what else he could be waiting for.*

The unsolicited development of such connections suggests that the *Links* tool might be very well utilized. It remains to be seen, however, whether or not the *Links* and *Media* tools might encourage even greater and more in depth explorations of commonalties and differences in the texts.

Conclusions

The results of our survey of commercially available hypermedia revealed that while such programs were generally high quality and linked to works commonly taught in schools, the pedagogical approaches taken were not response-based. Programs designed for elementary students commonly equated literature with reading; programs designed for high school populations generally adopted a traditional, text-centered approach. What was conspicuously absent was support for student responses. We therefore created two prototype applications, *Kidspace* and *the BEATS*, whose primary focus was to provide explicit online support for student responses to text. Our preliminary pilot testing of these applications suggests that they can uniquely enhance response-based teaching and learning given complementary instructional and technological environments.

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Paper Session

A New Model: The Development of a "Best Practice," Outcomes-Oriented, Field-Based Graduate Classroom Technology Program

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Key Words: **educational technology, computer education, masters programs, school reform, change, technology leadership, standards**

Abstract

K–12 and university faculty collaboratively develop courses and teach at school sites through Saturday intensives or electronic alternatives. Relevant research, specialty development, mission, goals, suggested competencies, "essential learnings," and exit outcomes are described.

The Challenges

Most school reform experts and researchers agree that a fundamental change is needed in both the content and pedagogy of the classroom (Abdal-Haqq, 1995, June; Knapp and Glenn, 1996; Means, et al., 1993; National Association of Secondary School Principals, 1996; Office of Technology Assessment, 1995; Smith and O'Day, 1990; Sykes and Plastrick, 1993; Sheingold and Hadley, 1990). While there are many excellent examples, technology has most often served as a complement to the "conventional instructional curriculum" wherein teachers "do not establish a significant link between the need for technology and identifiable instructional priorities" (Moersch, [online]).

The educational technology literature is replete with studies that recommend tying teacher staff development to relevant uses of classroom technology, yet bridging the gap between theory and practice in both the university and the school is difficult (Albert, 1994; Glennan and Melmed, 1996; Office of Educational Technology, 1995; Lachman, 1995; National Center for Education Statistics, 1996; Rowley, 1994; Rubin, 1996 Saye, 1994; Sheingold, 1991; Sheingold and Tucker, 1991; Waters and Gardner, 1990). The literature suggests that reforms fail when the use of technology is separated from the aims of curriculum (Wiske and Houde, 1988; Zorfass, Morocco and Lory, 1991). Melding technology use into current curriculum theory common to all teachers is needed to make technology integration meaningful.

Critical thinking, interdisciplinary teaching, integrated curricula, block scheduling, cooperative learning, learning styles, portfolios, inquiry-based learning, constructivist methods, performance assessments, multiple intelligences, integrated thematic instruction, change theory, brain research, etc., are all be amplified through technology (Ackerman, 1995; Brody, 1994; Brooks and Brooks, 1993; Drake, 1993; Johnson, Johnson, and Hollubec, 1994; Kovalik, 1994; McDonald, et al., 1993; Sylwester, 1995). Students and teachers must become what Robert Glaser calls "mindful architects of their own knowledge"—continually adapting, refining, connecting, and using what they learn in a "climate of pervasive change" (Maloy, 1993).

Blowing Away the Walls: What Educational Technology Can Be

It has "blown away the walls... and filled us with a sense of possibility... (Office of Educational Technology, 1995). At its best educational technology can open up the student, the teacher, the school, and the world, but there are theoretical, bureaucratic, and personal walls that resist such change.

> *Constructivist teaching will be best learned through constructivist staff development. Rather than receiving "knowledge" from "experts" in training sessions, teachers and administrators will collaborate with peers, researchers, and their own students to make sense of the teaching/learning process in their own contexts (Sparks, 1994).*

Change is the new paradigm and the only constant (Fullan, 1990; Sarason, 1990; Sparks, 1994). Kohn mentions in *Beyond Discipline* (1996) about giving a workshop that questions traditional assumptions about education in which

> *a teacher leaned over to a colleague during break and murmured, "Sometimes it makes me feel so insignificant." She waved her hand in the air, as if asking to be recognized. "Remember me?" She asked plaintively. "I want to be the teacher" (p. 137).*

Educators are no longer front and center, dispensing knowledge and expectations. Changes of this magnitude, wherein democratic schools are modeled, must be taught in ways that reflect these beliefs (Apple & Beane, 1995; Kohn, 1996). If teachers are to develop new ways of teaching and learning then they should learn them through modeling in the same way that current research and practice asks K–12 students to learn.

Developing a New Paradigm

The goal of this program was not to develop technology coordinators or computing teachers. Rather, this program had as its goal to put technology squarely into the hands of the individual teacher who could see the curriculum connections in light of the best of current school reform theory and practice. It was also based on the simple premise that teachers had a good idea of what they wanted to learn, so an Advisory Council was brought in to help develop the new program before it's adoption by the faculty.

Piloting the Model

Five pilot courses were offered in the '94–'95 school year and student profile information was collected and analyzed while teaching methodology and the logistics of teaching technology at exemplary school sites were refined. All-day sessions on three Saturdays in the semester for 2 hours were most common and were co-taught by at least one university faculty member and at least one practitioner in a school district. The syllabus for each course had course and daily outcomes, as well as a daily agenda for each class. Courses were cooperatively developed, often at the suggestion of students and the Advisory Council. Various types of needs assessments during courses provided a continual feedback mechanism for refining and changing program direction.

Class activities were developed based on brain research theory, performance assessment, multiple intelligences, cooperative learning principles, and integrated thematic instruction. For example, a "b-k" (behavioral-kinesthetic) break was given to allow students to exercise stretch through a long day. Activities were broken up so that students had time to cooperate, collaborate, share, and reflect on their learning. Kovalik (1994) states that teaching time should be no longer in minutes than the students are old, so activities were developed and executed with this premise in mind. Courses which taught multimedia program skills operated on the "see-cue-do" premise. The student viewed a presentation of a program, then the class was taken through a guided activity with the program, and then the student used the program for an activity.

Student Profile: I am Woman (And I Am Tired)

The following demographics were extracted: 1) 85% were women; 2) 90% were married; 3) 80% had one or more children at home; 4) the mean traveling time to reach the class was 1.75 hours each way, with the shortest being 20 minutes and the longest 4 and 1/2 hours; 5) 70% were practicing teachers, 25% were principals, curriculum directors, etc., and 5% were from business and industry, were undergraduates, or unemployed; 6) of those that were teachers the number of inservices of any kind ranged from 1 to 12, and the mean number was 4; 7) most took courses to recertify, although the common statement was, "I'm taking this course to recertify, but then, what course isn't?"; and 8) of those that were teachers, 60% were elementary, unless it was a course geared strictly to elementary, or secondary. These people were a busy, dedicated group of people from all across the state who did not receive as much inservice on technology uses in the classroom as they would like.

Student Feedback: Hopes and Concerns

Based on group work done in each class on this topic the "average" student in this program wanted to use authentic assessment, to have students learn processes, relationships, and applications, wanted training geared to multiple intelligences and non-traditional options, wanted access to the latest technology, desired community access, wanted student competencies not grade levels, and wanted staff to be open to change. As a group they believed the use of technology was most desirable as a tool to expand student educational opportunities and not just because a piece of software or hardware was the newest on the market. Most needed applications that could be directly and easily used in the classroom. A high learning curve on a program for the teacher/student was a "red flag" for a high learning curve in the classroom, so the use of such a program had to be justified in instructional terms.

Program Component/Competency Development

Two grants were secured for the development of the program that allowed face-to-face meetings to develop program components, one of which was sponsored by the state technology association (Mid-America Computers in Education). In keeping with the college theme of "knowledgeable, ethical, caring decision makers," the mission of this program was to "to help students become mindful architects of their own knowledge." Program goals were to develop teachers who: 1) use productivity, classroom management, and instructional applications of technology, 2) demonstrate strategies and skills for managing the change process in schools and 3) are leaders in the use of technology in the classroom and contribute to school and district technology planning and implementation.

With the help of the Advisory Council entrance requirements, program competencies, and exit outcomes were also developed. A new course is developed regularly and all applications courses are listed as Topics courses which allows for continual renewal. Each student must take 2 hours to complete a Technology Project appropriate to their level with an assessment for the Masters Oral and present a program portfolio containing performance evidence (Council of Chief State School Officers, 1995) of self-selected competencies from a suggested list extracted from the ISTE basic and advanced specialty standards and the ISTE/NCATE standards (Thomas, 1995). Because skills change, the student-selected competency evidence must be according to the "essential learnings" adapted from the State of Illinois (1996, October)—"information navigator, communicator, [knowledge architect], thinker/analyst, technician, and knowledgeable, responsible citizen in an information age." The aim is to bring graduates to the integration level of Moersch's taxonomy (1997) and to achieve a degree of alignment of teacher/student technology outcomes (Oregon State System of Higher Education [online]).

Other courses in development are a Classroom Technology Institute to be offered during the Summer 1998 semester and planned with the local school district. In the future, student ideas for course development will be accepted through the program Web site and Internet discussion group. Example work from each class will be placed on the Web site, which began with the Spring '97 Electronic Research Web site list and critical evaluation checklists. All core courses not available on Saturdays will be videotaped for distance uses.

Feedback and Future Plans and Hopes

Practitioner interest has been high. All instructor/practitioners have asked to continue to participate. The most frequent comment from both university and K–12 instructors is "I learned something today." Students remark that they have become interested in various concepts after seeing them modeled. While planning time has doubled or tripled, the stimulation of sharing and developing new ideas, learning new teaching techniques, and the cross-pollination of university/K–12 models, mandates, and issues is enriching and energizing.

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General Session: New Curriculum Designs/Instructional Strategies

The One-Computer Classroom

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Key Words: **one-computer classroom, mideo (video-microscopy system), sensor probes, educational CD, TV**

Many teachers face the problem of limited resources and are likely to begin with only one computer in their classroom. However, this should not limit students to taking their turn in having access to the computer. For a reasonably modest price, a computer can be connected to a classroom TV and the computer's monitor displayed on the TV for the whole class to view. This presentation showcases how appropriate interfaces and select software are utilized on a single computer in a high school general biology classroom.

The first section shows ways in which a computer can be used to carry out the daily functions of a chalkboard. ClarisWorks 4.0 will be the primary software featured in this section. The second section shows the peripherals that can be connected to the single computer and the range of teaching strategies possible with these add-ons. Examples of peripherals presented are CD-ROMs, sensor probes, mideo-videoscopy camera, VCR and LD players and modem and cable connections to the Internet. The last section shows ways in which a screensaver software (After Dark 3.0) is used on the computer to serve functions of providing security, a message board and a topic opener.

Other examples of one-computer classroom operations will be briefly shared in closing. We hope that participants in this session will find some useful ideas to take back to their classrooms.

Featured in this presentation are the following classroom strategies:

A. Use the Classroom Computer as a Chalkboard:

The ClarisWorks 4.0 slideshow feature converts ordinary word processing documents and spreadsheets instantly into neat and attractive appearance that can be displayed on the TV screen. Instead of writing, erasing and rewriting on the board for each period, simple daily instructions and assignments can be typed on the computer (spontaneously or in advance) and be displayed in attractive fontage and color on the TV screen. These messages can be saved and edited period after period, year after year. In class experiments where groups pool their data and need a large master data table, the computer's spreadsheet and graphing ability can be utilized and demonstrated by displaying them on the TV screen. Teachers can save time and paper printing quizzes. Class quizzes can be administered creatively from the computer by using ClarisWorks slideshow, and graded in class. Grades can also be announced and projected by displaying the entire grade sheet on the TV screen. Seating arrangements created on your spreadsheet can be easily updated and displayed on the TV screen.

Featured in this section will be the following:

Examples of:	*A Daily Class Announcement/Instruction/Assignment* *Class Data Table and Graph* *Class Quiz* *Grade sheet* *Seating Chart*
Software:	*ClarisWorks 4.0*

B. Use the Classroom Computer to Incorporate Technology Resources:

Having a reasonably high-end model for a single classroom computer opens up a whole array of technological resources for instruction right in the classroom. Some of these resources are:

CD-ROM
There are many educational CDs that can provide various forms of support in classroom instruction. Some CDs are directly instructional and educational; others are supportive or represent a resource library. Increasingly, textbook publishers are producing CD versions of their textbooks that provide instructional support in the form of tailor-made presentations, lesson plans, worksheets, tests, etc.

VCR/LD
Having a computer linked to the VCR or LD player enables the teacher to incorporate video clips into his/her presentation files and customize the lessons. Software such as HyperStudio 3.0 has this feature.

Mideo (Video-microscopy) Camera System
This is a high resolution, low-light color video camera that can be connected to the computer or directly to the TV. The mideo camera is great for demonstrating a single experiment or dissection to a whole class by projecting the demonstration on the TV screen. The mideo camera has a universal microscope adapter that fits over the eyepiece of the microscope and projects the microscope slide onto the TV so the whole class can see what is on one microscope slide. This works extremely well with demonstrations of pond water organisms. When hooked directly to the computer, the images may be saved and digitized.

Sensor probes
Class demonstration experiments using sensor probes are possible with a computer that is connected to the TV. Students have the opportunity to see a continuous variable in action as the computer reads and records the measurement at speeds of up to 50 readings per second.

Internet Resources
A computer hooked to the TV and connected to the Internet either by direct-connect or modem dial-up enables the teacher to bring the WWW into his/her lesson. By changing the font size under the Options menu, the entire contents of the WWW can be made readable to the whole class.

Featured in this section will be examples of:

Instructional CD: *Biology—The Dynamics of Life* (Glencoe)

Educational CD: *The Rainforest*

Mideo Camera: *Frog Dissection and Microscope Slide Demo*

Sensor probes: *Temperature Probes, Datalogger 4.0 Software*

Video: *HyperStudio 3.0 Software*

C. Use Your Single Computer as a Message Board

The After Dark 3.0 software is a screensaver with a password feature. This prevents unauthorized use of the classroom computer during busy moments when the computer is left on and unattended and the teacher's back is turned. Creative use of the screensaver's menu allows the computer to be useful even when not in use. Customized messages such as announcements and reminders can be used as a screensaver. Some screensavers make excellent topic openers for the classroom.

Featured in this section will be:

Examples of useful screensavers (*After Dark 3.0 software*)

Paper Session

A Virtual Instructional Media Center Unifying Professional Development and School Reform

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Key Words: **professional development, school reform, telecommunications projects, multimedia, school-community networks, collaboration**

Abstract

This is a natural, participant-driven and comprehensive environment for unifying professional development and school reform at key systemic levels: learners within classrooms; colleagues within and among schools and affinity groups; and among policy-makers, parents and allied community agencies and businesses.

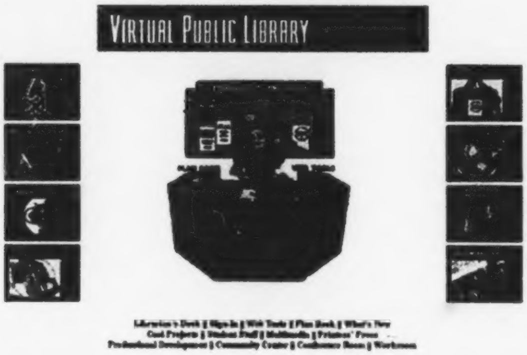
A central tenet of professional development and school reform is the creation of an enabling participant-driven environment for students and teachers alike. Web technology shares and promotes this same imperative. The key dynamics of the World Wide Web and school reform are exactly the same.

Our Virtual Library Instructional Media Center provides a comprehensive environment—chockfull of the requisite resources—for unifying professional development and school reform [1]. The site is designed as an immersive environment, supporting collaborative reform activities at key systemic levels: in the classroom with interactive telecommunications activities; within and among schools via multiple conferencing capabilities; and in concert with professional networks and stakeholders such as parents, business, and community groups. Teachers can not only collaborate across sites, but can share and receive recognition for their contributions by co-publishing them through the Media Center.

Here, we offer an overview of the site and examples of its use in five key streams of professional development and school reform.

Overview of the Site

Here is a view of the Lobby in the Instructional Media Center.


VIRTUAL PUBLIC LIBRARY
Librarian's Desk | Sign In | Web Tools | Plan Book | What's New
Cool Projects | Student Stuff | Multimedia | Printers' Press
Professional Development | Community Center | Conference Room | Workroom

The rooms, sections and shelves of the resource center are arranged hierarchically and stocked with carefully selected electronic learning resources and activities. Over 1000 listings of remote sites propel visitors into the center of networked science on the Web. This seed collection focuses broadly on environmental studies. Each entry is accompanied by descriptions and annotations. The sampling was assembled from many regions in the US, diverse agencies, varied dimensions of telecommunications and integrated subject topics for a wide range in student age, interests and capability. Valuable offline references are cited, too.

The Media Center is an open ended, participatory, and collaborative environment, encouraging teachers at remote sites to cooperatively develop and publish joint network science projects. Visitors start at the librarian's desk where they will find a rich selection of Web tools, technology, and policy guidelines that empower them to develop and customize their own sites. There is also a Plan Book that provides samples of curriculum and assessment frameworks for telecommunications activities in schools. The Cool Projects Room showcases classroom project investigations at national centers, museums, and at field sites and on treks around the world. The Multimedia Room features simulation and authoring software for creating educational products for schools and the workplace. The Student Stuff Room contains basic reference material, collaborative notebooks, and sites where students can participate in contests or exhibit and publish their work. The Professional Development Room includes tips for school reform, as well as tools and resources for professional publishing and networking—listservs, moos, bbs, Internet training courses, and conferences (both on- and offline). In the Community Center are case studies of school-community telecommunications networks and programs linking schools with homes, businesses and local agencies. A Conference Room facilitates cooperative work among remote colleagues through various real-time and asynchronous communications tools including a shared whiteboard, videoconferencing, and multimedia mail. Finally, the Printer's Press provides templates for publishing completed projects through the resource center, expanding the seed collection.

A key decision in the design of this site was the selection of a natural computer-human interface. Computer-human interface researchers have explored many metaphors for virtual, community-building environments. CDs aside, the current crop of educational environments ranges from Web pages with generic button icons (news, links, chat, search, directories, parent sites), and A–Z laundry lists (lessons, libraries, or listservs) to roadmaps (Hillside, NCREL) to villages (Computertown) to venues within a city scape cafes, left and right banks in Paris (Serim) to universities (Women in Technology International), and libraries with reference rooms (DOEd) and multiple-subject collections (Soloway's includes a MOO, too) to a student's world (Frazier, Kurshan, and Armstrong), to name a few [2].

We selected the Instructional Media Center as a computer-human interface metaphor, because such an environment is often the first stop for teachers undertaking innovative projects. We support familiar resources and work practices, and extend them with new telecommunications powers [3].

Applications to Professional Development and School Reform

Five streams of professional development have been identified in the service of reform by Little [4]. For each stream, we cite a few examples of how the library can help educators pursue reform.

1. Reforms in Subject Matter Teaching: Curriculum and Pedagogy

Most technology curriculum specialists are well-versed in online, constructivist projects and exhibits and have participated in or viewed e-mail exchanges of data and information (See Cool Projects Room). Recently, some new projects have emerged that subtly yet powerfully alter pedagogy through telecollaboration. For example, by amassing data from online observers around the world, an individual classroom can conduct scientific investigations based on detailed population statistics rather than small data samples or oversimplified estimates (GLOBE, Mendelian studies). Younger students can explore previously inaccessible nanoworlds by consulting online with university researchers, and accessing costly equipment such as electron microscopes and MRI scanners.

Our site emphasizes projects like the above in which telecollaboration is an essential ingredient. Other examples: one school in the Colorado mountains sought another school at sea level to partner in biology studies. Schools in Texas and around the Great Lakes cooperated to meticulously plot the microecologies of their regions, which appear as undifferentiated blobs in a traditional CD atlas. The San Francisco Exploratorium moderated the building of a virtual city from design modules, submitted from around the world. None of these projects could have been tackled at all without collaboration. Their content is authentic and rich (see Means [5])and the outcomes unknown [6].

2. Equity

Suffused throughout every library room are resources to facilitate the special needs of diverse student groups (e.g. physically disabled, limited English-speaking, young women seeking careers in science). With a few exceptions, such as the DOEd online library, most of these needs are absent in general, online collections and require searches in special databases.

Practitioners and policy-makers usually focus on the importance of affordable costs and universal access to establish equity in telecommunications. The implications of equity for education are profound: for the first time, de facto segregation in education can be virtually eliminated. Any teacher and student can visit museums, conduct research at university libraries, view up to the minute news feeds, participate in space, undersea and other far-flung expeditions. Moreover, learning communities can easily regulate and adapt their own environments (see Thornberg [7]). Systems analysts regard such self regulation as critical to any reform effort.

3. Nature, Extent, and Uses of Standards and Assessment

The commitment of many teachers to integrating traditional and alternative assessment often exceeds the power of the tools available to them—not a good portent for reform. The Plan Book and Student Stuff spaces contain subject matter benchmarks and software for preparing project portfolios. Three resources merit special attention for telecommunications-oriented learning projects: (1) self-assessing student notebooks for online project-based learning; (2) references to materials for assessing student groupwork, a necessity for collaborative projects; and (3) tools for transferring offline student projects to online files so that they can be remotely shared.

4. Professionalization of Teaching

Until now, most professional development opportunities have been outside the teacher's workplace, away from the desktop, classroom and school. Time and funding constraints have limited participation and dampened the sense of immediacy. This is compounded for development approaches that involve collaboration with colleagues. Some of these barriers can be surmounted in virtual environments.

The Professional Development Room assembles direct links to professional networks, associations and affinity groups for teachers and librarians/media specialists. This room also contains digests of successful results-driven strategies for school reform. The Web Tools space includes comprehensive resources and tools for Internet/Web training and site management, and together with the Conferencing Center, tools for doing collaborative research using the Web. Our philosophy is that technology and school reform must be intertwined from the getgo. Integrating both resources on one site should help new teaching professionals enter the world of telecommunications and thus accelerate the pace of change in schooling to better match the breathtaking speed of the evolution of new technologies.

Like other professionals, teachers need opportunities to publish their work. A quick glance through past NECC proceedings will confirm that in recent years teachers have become increasingly aware of opportunities for publishing their own work directly on the Web (e.g. Serim, Hillside, Armadillo and commercial hosting services). Mostly, these opportunities involve posting URLs and soliciting viewer feedback. Our site's capabilities advance this dimension of professionalization by including techniques for remote, collaborative authoring and publishing, tips for getting one's work picked up by search engines and listservs, as well as "follow-me" tools for sharing projects with colleagues [8].

5. Organization of Schooling

The Community Center Room includes resources for involving the larger community in teacher-led school reform. These include case studies of successful shared networks linking schools with homes, businesses (school to work programs), universities and other community activities. The potential impact of these school-community partnerships is unbounded. Wouldn't it be exciting if a whole community could "follow" students during their virtual trek to the Amazon? The BBN Testbed2 project is compiling a typology and catalog of such school-community partnerships [9].

At long last, the business community is providing the fuel for educational reform while acknowledging that educational professionals belong in the driver's seat. In a letter of support to LEA's for a 1995 DOE Challenge grant, for example, Ed McCracken, Chairman and CEO of Silicon Graphics and Chairman of the NIIA Advisory Council, wrote, "Silicon Valley companies are contributing $20 million (for equipment and connectivity) but we are not taking the leadership of or responsibility for these programs away from educators or the community.... No one is better qualified to develop this educational content than the teachers... themselves" [10].

Conclusion

Our virtual library and instructional media center empowers teachers to play a leadership role at ALL systemic levels of school reform. Traditionally, professional development has been geared toward "outmuscling" the system—more money, more training, more technology. More is important, surely, but the real source of strength in effecting change lies in identifying and applying pressure at critical points of control within the professionalization streams. Then, our professional community can be transformed into the lighthouse of this fable, transmitted from the electronic frontier in Puget Sound:

Station #1: Please divert your course 15° to the North to avoid a collision.

Station #2: Recommend you divert YOUR course 15° to the South to avoid a collision.

Station #1: This is the Captain of a US Navy ship. I say again, divert YOUR course.

Station #2: No. I say again, you divert YOUR course.

Station #1: THIS IS THE AIRCRAFT CARRIER ENTERPRISE. WE ARE A LARGE WARSHIP OF THE US NAVY. DIVERT YOUR COURSE NOW!

Station #2: This is the Puget Sound lighthouse. It's your call.

Footnotes

[1] <<http://vpl-imc.org/>>This library was developed as a prototype of the Instructional Media Center of the 21st Century under the auspices of the National Science Foundation through a contract to TERC, Cambridge, MA (617.547.0430) and a subcontract to Enterprise Integration Technologies, Menlo Park, CA (415.851.8608).

[2] URLs: hillside.coled.umn.edu; www.ncrel.org; computertown.com; (Serim) oii.org or prism.prs.k12.nj.us; (Women) witi.org; www.ed.gov; (Soloway) ipl.umich.edu. Deneen Frazier with Dr. Barbara Kurshan and Dr. Sara Armstrong, INTERNET FOR KIDS, Sybex, 1995.

[3] Technical Note: This configuration was also chosen to satisfy technical constraints, such as the use of multiple windows and display of multimedia. For instance, K–12 educators have not fully exploited the Web's capability for displaying multiple windows at once. A project might display an information source (e.g., museum exhibit, CD atlas or software demo, TV transmission or MRI image) in one window, while at the same time providing collaborative media such as a MOO, chat with a mentor, a shared white board or a student notebook in other windows. Another advantage of this site is its potential for scaleability, such as easy integration with distributed "branch" libraries. Other pertinent technical issues were presented during the Teaching and Learning workshop at the World Wide Web conference in Paris in May 1996.

[4] Little, J. W. (1993). "Teacher's Professional Development in a Climate of Educational Reform," Educational evaluation and policy analysis, Vol. 15, #2, 129–153.

[5] Means, B. & Olson, K. (1995). Technology's role in education reform, SRI International.

[6] Yet, these projects, even as a set, are one-up exemplars; a taxonomy for collaboration would link a spectrum of activities with expected learning outcomes.

[7] Thornberg, D. & Armstrong, S. (1995). Telecommunications in the classroom, Computer Learning Foundation and ISTE, p. 69ff. Bonnie Bracey, teacher representative on the NIIAC, also underscores the connection between these capacities and equity.

[8] The chaotic state of naming and structural organization of site resources gobbles precious learning time. This issue merits attention by relevant professional associations.

[9] http://nsn.bbn.com/. From their collection of case studies, one tidbit for promoting reform stands out; encourage school folk to use technology to meet a specific community need, such as conducting a survey. We would add: select a need which can BEST be met via telecommunications.

[10] Silicon Valley Challenge 2000: Improving Learning and Strengthening Communities with New Technologies, Submitted to the Department of Education, 1995. This author is a consultant on technology and student assessment for this project.

Internet Poster

Project Athena: Earth and Space Science for K–12

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Key Words: **science education, real-time data, project-based learning, K–12 curriculum, multimedia projects, weather, space, astronomy, oceanography, earth science, teacher guides, NASA outreach, remote-sensed data**

Description

Project Athena is a NASA funded science curriculum project in it's third year of activity. It provides teacher-tested materials written by educator/scientist teams accessible via the WWW. Athena instructional materials engage students in observing the world through online access to scientific data. Students can track drifter buoys, record earthquakes, locate tropical storms, active volcanoes and sunspots using up-to-the minute information about our dynamic planet. Student-centered projects are provided that relate to oceans, weather, Earth resources, and space and are aligned with Washington State's EALRs. The material is intended for direct use by students with appropriate assistance from teachers. The goal of Athena is to enhance the K–12 science curriculum, and facilitate use of the powerful computational tools in classrooms networked to the Web.

Scientists and educators work together developing instructional material for use in K–12 classrooms based on data acquired via Internet. The materials include data sets with appropriate explanation, student activities, and teacher background information delivered to classrooms via pages on the World Wide Web.

Project staff members train teachers and provide support for 18 pilot sites in Seattle area classrooms. We support the pilot classes with onsite visits and e-mail, solicit feedback, and continue writing material in light of the classroom experience. The project is a collaboration between SAIC, the Washington State Office of the Superintendent of Public Instruction, and the school districts of Seattle, Bellevue, Lake Washington, and Northshore.

This project fills a need by making scientific data accessible to students in an understandable form. It does this by involving educators in planning and writing and piloting the material in classrooms. It provides a template for lessons and a model for collaboration between schools, business, and the government.

Target Audience

K–12 classroom teachers and students. Athena instructional materials are available to anyone with a connection to the WWW. We welcome feedback and suggestions and hope that our materials, after testing and refinement in the piloting process, prove to be useful in a wide range of classrooms.

Calendar

- 1994–95: Initial development of instructional materials, formation of collaborative teams of educators and scientists.
- Summer 1995: Training of Pilot Teachers.
- 1995–96: Ongoing development and refinement of instructional materials. Mentoring by scientists in local pilot classrooms.
- Summer 1996: Writing Institute and Trainer of Trainer workshops.
- 1996–97: Continuing development and refinement of instructional materials.
- Summer 1997: Writing Institute and dissemination workshops.

Sponsoring Organizations

Athena is one of NASA's "Public Use of Earth and Space Science Data Over the Internet" projects, part of the IITA (Information Infrastructure Technology and Applications) program of the HPCC (High Performance Computing and Communications) initiative. SAIC (Science Applications International Corporation) manages the project in partnership with Washington State's Office of the Superintendent of Public Instruction, and the school districts of Seattle, Bellevue, Lake Washington, and Northshore.

General Session: Society Session/Technology Implementation/Educational Reform (Organized by ISTE)

National Educational Technology Standards (NETS) Project

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Key Words: **accreditation, standards, technology, K–12, education**

Summary

Goals 2000 launched the nation on a course of school improvement through a process which focuses on high standards for student performances and development of local, state, and national plans for their achievement. Technology has been specifically identified as an area which must be addressed in these school improvement plans. This session will focus on a planning project funded by NASA in consultation with the U.S. Department of Education and the National Science Foundation. The National Educational Technology Standards (NETS) Project is designed to develop technology competency standards for K–12 students, establish specific applications of technology throughout the curriculum, provide standards for support of technology in K–12 schools, and address students assessment and evaluation of technology use to improve learning. The project's goal is to enable, through coordination and technical expertise, major stakeholders in PreK–12 education to develop national standards for the educational uses of technology that will facilitate school improvement in America.

ISTE has joined with other leading professional education organizations in the National Educational Technology Standards (NETS) Project. The initial function of this federally funded project is to develop standards for educational technology for grades PreK–12. The Partners envision development of milestones that will guide schools/districts in establishing their local plans for integrating technology with curriculum and management efforts. Initial drafts advocate establishment of learning environments that facilitate information and communications skills, creativity, collaborative learning, problem-solving, and informed decision-making. These environments are aimed at providing students with fundamental technology skills learned through practice in meaningful, real world settings while developing responsible, ethical attitudes towards technology and learning. Partner organizations include:

- American Federation of Teachers (AFT)
- Association for Supervision and Curriculum Development (ASCD)
- Council of Chief State School Officers (CCSSO)
- Council on Exceptional Children (CEC)
- International Society for Technology in Education (ISTE)
- National Association of Elementary School Principals (NAESP)
- National Association of Secondary School Principals (NASSP)
- National Education Association (NEA)
- National School Boards Association (NSBA)
- National Fund for Improvement of Education (NFIE)
- Software Publisher's Association (SPA)

Over three years, these groups are developing the following sets of standards for K–12 education:

- Technology Foundations Standards—describing what students should know about technology and be able to do with technology;

- Standards for Using Technology in Learning and Teaching—describing how technology should be used throughout the curriculum to teaching, learning, and instructional management;
- Educational Technology Support Standards—describing systems, access, staff development, and support services schools should provide; and
- Standards for Student Assessment and Evaluation of Technology Use—describing means of assessing student progress and evaluating the use of technology in learning and teaching.

Liaisons representing major curriculum groups will participate in the development of technology standards for their subject areas. The Curriculum Liaisons will participate in standards development worksessions designed to identify standards relating specifically to each curriculum area and to build interdisciplinary connections among the curricular areas. Joining the partner organizations in this project are representatives from:

- International Reading Association (IRA)
- National Council for Geography Education (NCGE)
- National Council for the Social Studies (NCSS)
- National Council for Teachers of Mathematics (NCTM)
- National Council for the Teachers of English (NCTE)
- National Science Teacher's Association (NSTA)

This planning project uses a standards development process derived from the experiences of NCTM and ISTE. Its focus is on an iterative, collaborative process governed by key stakeholders and others responsible for funding and implementing the resulting standards. This session is designed to share standards drafts and collect input from the audience on curricular applications of these standards. Two standards documents have been developed: (1) Profiles of a Technology Literate Student—broad statements of what students should know and be able to do with technology at the grade ranges PreK–2, 3–5, 6–8, and 9–12; and (2) Standards Domains and Performance Indicators—broad areas of preparation in technology and specific performance indicators arranged by grade ranges. Participants will review the Profiles, discuss samples of curricular applications of the standards, and provide input regarding additional classroom activities that use technology to support curricular aims.

General Session: Technology Implementation/Educational Reform

Technology Inservice: A Journey, Not a Family Vacation

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Key Words: **inservice, technology reform, restructuring, teacher training**

Technology has moved into the schools, but teacher inservice is still lagging behind. Large districts may have the resources to provide quality inservice to their staff, but small districts and rural schools often have no place to turn. Technology combined with summer training can create a community for teachers that will provide the necessary assistance.

Effective technology inservice is about much more than technology. Seymour Papert said, "Nothing could be more absurd than an experiment in which computers are placed in a classroom where nothing else is changed." Teachers must be immersed in an environment where a variety of instructional strategies are used to explore appropriate uses of technology. Educators need time and a nurturing environment where they can work through the stages of awareness, use and integration of technology in the classroom.

In the summer of 1995 and 1996 the Springfield Public Schools hosted the Ameritech Academy for rural schools. The academy was created in response to the results of a survey conducted by the Illinois Distance Learning Foundation which revealed that Illinois educators need assistance in understanding and in using the multiple technologies now available in the teaching and learning process. The class was designed around the Project LINCOLN model. This model has been successfully used in the Springfield schools in grades 5–8 and will be expanded to the high schools beginning in the '97–'98 school year.

Each school in the summer program sent a team of three educators, that included one administrator, to the week long academy. The summer inservice was designed to immerse teachers in new instructional strategies, and to keep administrators informed about the changing role of technology and the specific needs teachers would have. Participants used e-mail and conferences during the year to continue the inservice process and create a community of rural educators.

The goals of the Ameritech Academy were to:

- Explore instructional strategies to encourage active student learning
- Model the use of technology to support teaching and learning
- Preview new technologies
- Investigate the changes occurring in education
- Create a community of rural educators who are exploring technology and its role in the classroom

This panel will discuss:

- Inservice strategies that involve teachers in realistic models of cooperative learning, thematic units and technology integration
- Ways to support teachers as they become involved in a situation that puts them in the role of learner
- Examples of an integrated technology program
- Obstacles to successful technology inservice and integration
- Role of the administration in technology inservice
- How to create a community of learners that will benefit teachers

Paper Session

The Internet and the Humanities

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Key Words: **Internet, Humanities, network, communication, World Wide Web, culture**

Abstract

This paper serves a two-fold purpose. First, the authors sort out and review current ideas about what the Internet actually is. Second, and given those ideas, the authors look at whether the Internet is useful, helpful or even necessary for humanities classes. They argue that it is not, in its current state, but conclude by offering some ideas about how they would like the Internet to grow, and how to bring that kind of Internet into existence.

I. What Is the Internet?

At the simplest level the "Internet" is a network of networks that allows us to (1) send and receive electronic messages (e-mail), (2) engage in real-time conversations, games, and fictions (IRC, MUDS), (3) remotely operate components of or download from remote computers (telnet, gopher, ftp protocols), and (4) send and receive hypermedia-based information (the World Wide Web). Increasingly, however, the terms "Internet" and "World Wide Web" are becoming interchangeable, particularly as Web browsers accommodate more and more functions (1), (2), and (3).

Beyond these straightforward definitions, however, there is surprisingly little agreement about the significance of the Internet, beyond the fact that it has some, and even less about what it's for. In some ways this is not surprising; before the advent of the Web there were no calls for, in effect, new kinds of documents, involving readers as much as writers in deciding what would be in the text; there were no calls for interactive movies, much less for interactive movies that would combine words, sounds and images in a new *place*, the attributes of which are unclear, evolving, and fluid. We have been re-inventing the document, the movie, the image, in the absence of any feeling that there was anything structurally or formally the matter with documents or movies or images. Perhaps these changes, or something like them, were being foretold in the work of Derrida, Foucault, and others, in essays like Foucault's "What is an Author?", in which he describes authorless words endlessly circulating in what was then (1979) an imagined, not an electronic, space; but this kind of literary "deconstruction" is still an acquired taste, and was almost certainly not being read by the 19-year-old hackers who were the first creators of interactive computer-based "hypertexts."

So in the absence of causes (causes we understand), there is widespread disagreement about the *effects* of Web-based, and even computer-based, technology. Neil Postman justly laments that new digital technologies contribute, he says, to the downfall of reasoned discourse; the result is a cultural wasteland he describes as "technopoly."[2] At the other end of the spectrum, Richard Lanham argues that the new digital technologies reinforce and reinvigorate the "rhetorical" ideals of western culture—[3] and we have ourselves argued that modern communications technologies, particularly those embodied in the Internet (and other electronic communities such as the French Minitel experiment) carry with them cultural values emblematic of the west—challenges to central authority, the enabling of all speakers equally, the devaluing of the fixed "document" for the sake of new, opportunistic readers.[4]

But there are other perspectives. In *Road Warriors*, David Berstein and Daniel Kline let us listen to Don Logan, President and CEO of Time, Inc., in a speech to the Association of National Advertisers: "Stop thinking of it [the Internet] as the information highway and start thinking of it as the marketing superhighway. Doesn't it sound better already?"[5]

But, as Burstein and Kline themselves point out, while corporate planning proceeds apace, the actual environment in which this new "superhighway" must prosper is hardly ideal. Not having been designed, it wasn't designed for business; the Internet is extremely decentralized, often anarchic, and so remarkably open that, at least with regard to the first level of access, a single person's workstation stands on an equal footing with the mainframes at (for example) the Library of Congress. That all users, all addresses, are equally privileged and equally available tends to defeat conventional marketing schemes; Burstein and Kline conclude that while the Internet has the potential to become a new marketplace, it "will not become the principle information highway that corporate America depends upon for its most critical data and financial traffic."[6]

George Gilder, on the other hand, is enthusiastic. An advocate for the "wired" future, Gilder's ideas have gained favor with Newt Gingrich and a Republican congress; he argues that "bandwidth is going to be virtually free in the next era in the same way that transistors are in this era."[7] Gilder contends that this new wired culture will allow the United States economy to lead the way in the new interactive medium, provided the government takes the lead in removing regulatory obstacles that inhibit the growth of fiber optic deployment.[8]

Whether Burstein and Kline or Gilder are correct is less important for our purposes than the fact that all three see the Internet as an economic, rather than a cultural (or educational) frontier. What gets *delivered* by that fiber optic cable, may, it is true, have educational (and cultural) potential; but it is the potential for delivery of content, not the content itself, that attracts the interest. While systems for the delivery of information are automatically of some interest to educators, including humanities educators, information alone is only one component, not always the most important, of an education! What we "know" about Shakespeare is much less significant than what we experience, react to and evaluate, together, in his plays. To simply deliver "information" about Shakespeare—to increase the bandwidth—is to miss the educational, and even with time, the economic point.

But maybe the Internet is not primarily an economic phenomenon at all, whatever its economic potential. For Sherry Turkle it is a mechanism for finding, locating, studying, oneself. "The Internet has become a significant social laboratory for experimenting with the constructions and reconstructions of self that characterize postmodern life."[9] Turkle's studies of MUDS (Multi-User DungeonS), in which participants take on alternate identities, suggest a deeper exploration of the self (or selves), as in Turkle's description of one MUDer's experience (Julee) in reevaluating her relationship with her mother via her "role" in a MUD experience.[10] This kind of self-exploration offers new and intriguing possibilities for humanities education: readers reading themselves in a fictionalized, if not actually fictional, universe, moving in a place both real and virtual—put this way it doesn't sound so very different than reading a novel, but in actual (institutional) educational contexts it's a little hard to see how this would work. What would we ask students to do? We can and do ask them to read, but is it clear that all students would react to MUD-like situations in the same way? Some might be terrified, some indifferent, whatever their academic skills. And whatever virtues they derive from interactive role-playing fictions, are they the same, comparable to or different from those that conventional fiction encourages? The simple answer is that we don't know. Turkle herself calls MUDS and similar role-playing arenas "social laboratories," implying that their impact is sociological (and psychological), rather than strictly educational. Are they also authorless novels, or novels in which readers become authors? Maybe; but is it "authors" that we ask our students to be, exactly? The point of reading Shakespeare isn't to *be* Shakespeare. No one would be unhappy if it happened, but what we ask is not that anyone "be" a playwright, a judge, a doctor, or anything in particular, but to summon up as much "negative capability" (Keats' phrase) as possible and go selflessly where the fiction goes. Even if Internet-based role-playing fictions *are* laboratories of the self, "selves" are not all that we ask an education to produce.

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[2] Postman, N. (1992). *Technopoly: The Surrender of Culture to Technology*, NY, Knopf, esp. pp. 56–72.

[3] Lanham, R. (1993). *The Electronic Word*, Chicago, Univ. of Chicago Press, p. 108.

[4] Thurber, B. & Pope, J. "Computers and Western Culture." IFIP International Conference, Birmingham, England, June 25–29, 1995.

[5] Burstein, D. (1995). *Road Warriors: Dreams and Nightmares Along the Information Highway*, NY: Dutton, p. 101.

[6] *Road Warriors*, p. 127.

[7] Gilder, G. & Kelly, K. *Hot Wired* Interview, 1995. (HotWired Web site)

[8] Gilder, G. (1992). *Life After TV*, NY: Norton, p. 125.

Perhaps, though, we need to modify this paraphrase of Turkle's view. Sproull and Kiesler, in a study of the "second level" or system effects of electronic mail on organizations, note an increased sense of "group membership" among those who use electronic communication for information and discussion of organizational issues.[11] Clearly these large scale social effects will modify whatever individual self-experimentation the Internet also enables; the Internet isn't self-building, it's community building. Turkle deals with this complication by describing the electronic computer as the "postmodern era's primary object-to-think-with, not simply part of larger cultural movements but carriers of new ways of knowing."[12] It is implicated, that is, at *both* social and personal levels. Indeed, Turkle begins her discourse by describing the "seduction" of the computer as object with which one must negotiate a working relationship (p. 9), much as if the computer had a life of its own. Building on the postmodern view of the self as a construct of many potential (virtual!) selves, Turkle's primary thesis is that "the Internet... has contributed to thinking about identity as multiplicity. On it, people are able to build a self by cycling through many selves."[13] It is not simply that the computer builds *both* selves and social networks; the self *is* the social network, a unique electronic fusion of public and private, corporate and individual.

Others (of course) disagree. The Internet is not a new ontological or psychic home; the self does not signify so much as the campfire, the potlatch (!), the virtual gathering place. Examples of electronic "communities," interest groups, listservs are easy to find and (generally) easy to subscribe to, involving topics as diverse as gardening, Asian cooking, bomb making or pornography. In *The Virtual Community: Homesteading on the Electronic Frontier*, Howard Rheingold describes the myriad ways such electronic communities now prosper on the Net.[14] Rheingold even describes logging into the Well (a Berkeley-based virtual community of long standing) in terms of the neighborhood cafe: "The feeling of logging into the Well, even for a minute or two, dozens of times a day is very similar to the feeling of peeking into the café, the pub, the common room to see who's there, and whether you want to stay around for a chat."[15] Just don't ask Clifford Stoll; "The Internet began as a technical community, with convivial neighbors who'd help each other. Its friendly anarchy promised to revolutionize social interactions and transcend political boundaries. With time, it developed into something less."[16] For Stoll, the signal-to-noise ratio in these electronic cafés has become so small that the value of "community" is severely diminished and, far from "cycling through many selves," he'll cycle through none at all.

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[9] Turkle, S. (1995). *Life on the Screen: Identity in the Age of the Internet*, NY: Simon & Schuster, p. 180.

[10] Turkle, p. 186ff.

[11] Sproull, L. & Kiesler, S. (1992). *Connections: New Ways of Working in the Networked Organization*, Cambridge, MA: MIT Press, p. 84ff.

[12] Turkle, p. 48.

[13] Turkle, p. 178.

[14] Rheingold, H. (1993). *The Virtual Community: Homesteading on the Electronic Frontier*, Reading, MA: Harper Collins.

But no, according to Nicholas Negroponte (among others; our list of writers about the Internet is necessarily arbitrary and short):

> *"Computing is not about computers any more. It is about living... We have seen computers move out of giant air-conditioned rooms into closets, then onto desktops, and now onto our laps and pockets... As we interconnect ourselves, many of the values of a nationstate will give way to those of both larger and smaller electronic communities. We will socialize in digital neighborhoods in which physical space will be irrelevant and time will play a different role... Reading about Patagonia can include the sensory experience of going there. A book by William Buckley can be a conversation with him."*[17]

So, since there is such widespread disagreement, and since we also don't know how many people use the Internet, how often, and for what purposes, nor what at any given moment is even *on* the Internet, it's safe to say that in vital respects the Internet remains undefined. It is a whole series of clustered metaphors or a single metaphor waiting to happen; it is each of us or all of us, all of us or none, all of the above and none of the above.

II. The Internet and the Humanities

That we don't know quite what the Internet is could alone keep it from the humanities classroom; why bother with something still in the process of being invented? Alternatively, we could use the humanities classroom to help invent the Internet; in the end this will be the path we recommend, but it's not immediately clear that any advantage lies in this direction either. Assume for a moment that *each* of the definitions we have just rehearsed is true. None possess any advantages, or even much relevance, for the humanities classroom.

The tasks are different. Though the Internet clearly allows us to do things we couldn't do before, what it does allow isn't (yet) particularly illuminating.

If we can cycle through innumerable postmodern virtual selves, or hang out in a virtual cafe, we still have Macbeth to make sense of, or the causes of World War I, or what Hegel owes to Kant. These matters can all be—stipulate that they are—*discussed* on the Internet, but that does not relieve any of us of the burden of entering into the discussion for ourselves, as ourselves, for better or worse. There is no shortage of real-time chat rooms, e-mail, humanities-based Web pages or listservs; none, though, serve more than a bibliographic function, providing us, as libraries do now, with resources to be considered as we speak with our own voices. None can actually *be* our own voice, as the Internet is presently constituted, nor do we much want it to. There is a considerable gain in convenience, to be sure, if writers on related topics, music, visual images, performances of various kinds, or research on similar events or circumstances can be made instantly available at, say, everyone's personal Web site; but even if "instantly" were a reality, a gain in convenience is not a fundamental change in what persons in the humanities actually do. It might be nice to know what, or if, Browning thought of "In Memoriam"; but whatever he thought is only tangentially related to what any of us think, and only then if we decide it is. In any case "nice" doesn't equal vital; maybe the revolution in computer-based electronic communications has nothing much to do with the humanities.

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[15] Rheingold, p. 26.

[16] Stoll, C. (1995). *Silicon Snake Oil*, NY: Doubleday, pp. 112–113.

[17] Negroponte, N. (1995). *Being Digital*, NY: Knopf, pp. 6–7.

That at least is what some of our colleagues in the humanities have been saying, perhaps *sotto voce*. We disagree, but we want to recognize that those of us who have been regretting the influence of the computer on the academy have a point. If we can talk to William Buckley while we read his book, so what? Is the author the sole judge of what any of his (her) books mean? Should he (or she) be? Isn't discourse with the author a fundamentally different thing than discourse *by* the author, in which that author actually commits to *this* version, the "hard copy," the default, the book? And by the way, what *is* the relation between fiction (or non-fiction, for that matter) and the author? Does the author simply shed meaning into the text, or do we all, collectively, on a listserv perhaps, but also privately, for ourselves?

These are weighty questions; our point in raising them is just to suggest that there may be (good) reasons why computers and computer networks have caught on more slowly in the humanities than elsewhere.

III. An Internet for the Humanities

None of us, individually or collectively, can or arguably should change the Internet to suit our own purposes. We can change, though, the interface between ourselves and the Internet, particularly through that most malleable of documents, the Web page.

To date Web pages in the humanities have evinced certain similarities. There is an e-mail capability. Reference materials, written, verbal, visual and aural, may be available either at the Web site itself or via hypertext (or hypermedia) links elsewhere. Related resources will be noted and, typically, links provided. Finally, a number of sites, notably at the University of Texas, at Brown and elsewhere, are beginning to provide real-time or close to real-time chat capabilities. Sometimes this has meant simply providing transcripts of real-time chats occurring earlier, on a particular campus. Sometimes, though, off-campus interested others can join in as well.

We would argue, first of all, that real-time chat functions should play a much larger role in online investigations in the humanities—not because the Internet allows it, but because *conversation*, among ourselves, with interested others, with authors dead or alive, constitutes the methodological heart of the humanities—where there isn't so much a body of information to be mastered (there is) as a voice, your own, to learn to speak with. This "voicing" of inquiry is crucial, highly individual, and is in fact, we would argue, what the humanities are *for*. There is a caveat; we don't know to what extent virtual conversation mimics real, face-to-face, conversation; the phenomenological difference being so great, we doubt it does. So we wouldn't *replace* real conversations with virtual ones; there will always be a campus. We would use virtual talk to supplement the conversations we actually have, so that we all engage in more, and in more kinds, of conversations.

Secondly, there is a kind of congenital problem with computers and with the Internet, particularly where our students are concerned, which is that we can't talk back. The Internet in particular is a kind of pre-existing world in which (recall Turkle first establishing a relationship with her machine) each of us is a stranger, on the loose in a world none of us had much of a hand in making. This strangeness, this otherness, we think, has as much as anything put workers in the humanities off computers and things computer-like—and not simply the strangeness, but the fact that there hasn't been much we could do about it—to *own* it, speak it, make it familiar. It's a kind of powerlessness unfamiliar in the humanities, where the entire point is to speak, to occupy, to voice oneself as oneself. Pretty hard to do on the Internet, where the procedures can still be arcane and the voices, the millions of voices, deafening.

So our last suggestion has to do with enlarging the scope of existing Web pages, by allowing visitors not simply to react to what's there, but add to it. What we want are word/image/sound processors that are also HTML editors (these exist) *and* Web browsers, so that each of us can, in effect, occupy an electronic space, but be there both as authors *and* readers, listeners *and* speakers, reacting to others' links but also adding (or deleting!) our own. If Turkle is right and ego boundaries are more fluid on the Net than elsewhere, we think the point, certainly the educational point, isn't to increase all this terminal freedom but to reduce it—by allowing our students, ourselves, and the humanities generally the chance to occupy this new electronic space as ourselves, as empowered as those who first created it. If we're instructors, we can certainly evaluate our students efforts in this direction, in the same ways we evaluate their efforts now; but as essay might be an essay plus a set of links, a series of recorded (or actual) real-time conversations, a *path*, from Web site to Web site, with commentary. Or something quite different.

The software to do all this does not yet exist, quite, and there will certainly be development problems—problems too with, for example, preserving the integrity of the Web site if the site is variable by its visitors. Something like that variability, though, we think is crucial. It's why we are currently engaged in a cooperative effort to create a Web site like the one we have just described.

It is just this variability, this principled surrender of centralized authority in favor of individual users, that has characterized both the Internet and the explosive growth in personal (as opposed to mainframe) computers. But it can also generate a new kind of home for the humanities on the Internet, because it generates the possibility of voice, of individuality, of the chance that even those unversed (unvoiced) in computers can, finally, write back. User-variable Web sites can allow each of us to "own" the Internet in new and personally enabling ways, even though at every moment there are a million other "owners" too.

It is this possibility that we are here today to celebrate.

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Workshop

Hands-On Virtual Rome! Navigating a "G" Rated Multi-User Shared Hallucination

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Key Words: **text-based, distance learning, multi-user, Internet chat, curriculum integration, MUSH, MU*, MUD**

Abstract

Virtual Rome is an educational MUSH (Multi User Shared Hallucination). A MUSH provides an online environment where people from all over the world can meet and 'talk' in real time, rather like IRCs. However a MUSH is much more than this. MUSHes consist of lots of different rooms, rather like the old style text computer adventure games. People can move from room to room, exploring the MUSH world, talking to people they meet, creating and solving puzzles, role-playing and helping to add to the world themselves. MUSHes are staffed by groups of 'Wizards' and other administrators who set up the MUSH, help the other players and try to keep things running smoothly.

The Virtual Rome project, begun at the Baker Demonstration School, was designed to provide interactive learning experiences in a recreation of Imperial Rome. It has grown to include students, teachers, and other interested participants from an international audience. This simulation allows visitors to become citizens of Rome, and to participate in daily life as experienced at that time. The interactive nature allows for exploration and interchange between people from a varied range of backgrounds and locations. Interactions take place among the participants and among created personalities residing in the MUSH.

Virtual Rome is a "G" MUSH set in ancient Rome. On this MUSH the children can:

a. role-play with each other, playing the parts of ancient Romans.
b. wander around the MUSH, exploring and encountering interesting places as well as other 'citizens.'
c. add to the MUSH themselves: building houses, businesses and other places all in keeping with theme of ancient Rome.

As a result of all these activities, the children learn a lot about ancient Rome in a fun and enjoyable way. In addition some children attempt to learn more about the way the MUSH works, coding objects and sometimes even joining the staff on the MUSH. Not only does such involvement improve the MUSH as a whole, it also helps the children develop useful qualities

and skills. The most obvious skill developments are in keyboarding, use of descriptive language and peer to peer communications skills. Here is a student's comment about working on Rome:

A letter from Paulus:

> Date: Fri, 30 Aug 1996 10:48:16 -0500 (CDT)
> From: David Galatzer-Levy <galatzer@netural.com>
> To: bthu@nlu.nl.edu
> Subject: Rome
>
> On Rome I go into a new world, if music is playing I only hear the hustle and bustle of the streets of Rome. On, or should I say 'in,' Rome you need to learn if you want to do anything. The admin., which I'm one of now, makes this learning easy, very appealing to folks who hate to read manuals.
>
> Rome is a place where you forget yourself, some feel as they do not want to so they go to the OOC (Out Of Character) room. Your power, as a normal player if you set your mind to it, is limitless.
>
> These are a few of the traits that make you want to be on Rome. All the summer I had free with my computer was Rome. The day my computer was fixed I spent 5–6 hours on Rome. During the year I meet the classes on Rome when I am sick. 60% of your time is spent on eating and sleeping, the other 40% on Rome.

This workshop is designed to introduce attendees to the educational possibilities inherent in such an activity. Learning objectives at the root of the project include language, social sciences, geography, mathematics, and other subject areas, as well as development of social and interpersonal skills. In addition, participation enhances the students' technological skills by allowing them to add to the structure of the MUSH. The participants at this conference will learn some of the techniques of operating within a simulated environment and will participate in real time with other users. This presentation will serve as a jumping off point for increased use of Internet capabilities for instructional purposes beyond the use of e-mail and chat facilities.

URL for support information:
http://www.iceberg.org/~alexj/rome.html

This URL has several links to pages with more links to Web information used for MUSHing, software, and Roman history. Participants in this project used books magazines, videotapes resident experts, and other sources of information as well. The URL also contains links to student programming examples and integrated lessons.

General Session: Current/Emerging Technologies

Combining Distance Education and Digitized Multimedia: Some Lessons to be Learned

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Key Words: **distance education, multimedia, computer-assisted instruction**

As a state university with a mandate to provide opportunities in higher education throughout the northeast corner of Ohio, the Kent State University system includes seven campuses. Some of the six branch campuses are well over an hour's drive from the main campus, and a few are almost two hours away. This part of the country also experiences severe winter weather for several months, making driving conditions rather hazardous at times. Travel between the regional campuses and the main campus, where most of the coursework is offered, can be inconvenient and time-consuming. Providing more coursework at regional campuses via a distance education system makes a great deal of sense.

The "LearnLink" Project

Two years ago, the university established a Distance Education project to connect all seven of its campuses. After considering the use of full screen two-way television, it was decided instead that the system would be computer-based, with a compressed video component. Partners in this project were IBM and a software company named ILink that had developed computer software for transmitting data across networks. Kent State became a beta test site for this "LearnLink" software, and several courses have been taught at multiple sites, using this approach. The term "Distributive Learning" to distinguish this computerized approach from television-based systems, which are generally referred to as "Distance Learning."

Each campus will have its own Distributive Learning Classroom. This special classroom is essentially a networked computer laboratory with compressed video capability. Beside each computer is a small color camera with microphone. A part of the computer screen is used for low quality television transmission between participants. The instructor can control who appears on-screen in the video box and what computer screen will appear on all of the students' computers. Students can signal the instructor via the network that they would like "the floor," as it is termed, and they can appear in the video box on everyone's computer. In addition to communicating on Kent's own network, there is access to the World Wide Web through Netscape.

LearnLink supports the Toolbook authoring language, so lessons for this system need to be developed in advance, using Toolbook. The faculty who have offered to teach as part of the pilot phase of the project, including the presenter, have each been assigned a programmer to help them develop lessons. In this way, multimedia lessons have been developed to use for distance education, which include sound, still pictures, and video footage. Kent State's system can provide extremely dynamic forms of lively, interactive instruction that students at remote sites can use, at their own pace, each sitting at their own computer. This "Distributive Learning" system has tremendous instructional potential.

The Potential of "Distributive Learning"

What is the potential of such a system? First of all, the system is computer-based, so it can deliver instruction that takes advantage of the computer's considerable capabilities. One of these advantages is that instruction can be systematically planned in advance and developed carefully, following principles of good instructional design. The lessons, once developed, can be used repeatedly by students in subsequent classes. These lessons can be revised and improved, based upon instructor and student reactions to working with them. They can be made highly interactive. Students can answer questions and receive feedback regarding their responses. The computer can also encourage them, when they are doing well. When they are not, the computer can provide hints and remediation. It can also branch to other parts of the unit, if the material is either too difficult or too easy for the student. Students can move at their own pace through the unit. Instruction can, in this fashion, be highly individualized (Hannifin and Peck, 1988).

Today's powerful computers have the ability to provide a wide variety of different types of materials. In addition to text, pictures, sounds, and video materials can be incorporated into the lessons. These digitized multimedia materials can enliven a lesson. The visual material can help clarify key points. Audio can also be very helpful, especially for topics like music and language instruction.

In addition to being able to present video segments, the LearnLink system provides a window on the computer screen wherein a compressed video signal is shown. This signal comes from a small camera, with a microphone, placed next to each computer. So students can see and hear the instructor, or any student who takes control of the system. This feature allows for face-to-face interaction between participants. Discussions can be held, and participants can get to know one another. It can significantly enhance the social dimension of this type of class and provide a more personalized experience than some other forms of distance learning.

Delivering this instruction via telecommunications lines to students at remote sites has several potential advantages. For the students at remote sites, they need not travel long distances. Because it is more convenient, other students in these locations may decide to enroll. Students who otherwise might not consider pursuing studies at the college level might take advantage of these opportunities (Willis, 1993).

Hopefully, this experience will also benefit the instructor. If the equipment is user-friendly, the teaching experience could be similar to working in a self-contained classroom. Some might find it interesting to teach across multiple sites and meet the challenges associated with this experience.

Overall, the system has obvious potential benefits for students from the regional campus sites. It also may contribute to faculty development. The university itself might benefit considerably. Kent State may be able to augment its offerings at regional campuses and expand enrollment. Higher enrollment would increase income and would also help the institution fulfill its mission to bring higher education to the entire northeastern corner of the state. If LearnLink is ultimately used by other universities, Kent State might be able to market the courses it has developed for use on the system.

The Challenges Faced by "Distributive Learning"

The considerable potential of "Distributive Learning" is matched only by the magnitude of the challenges it faces. The more technically sophisticated a system is, the more prone to glitches it is. Providing computer-based instruction for entire college level courses is an ambitious venture to begin with, even without the additional challenge of trying to send it across telecommunications lines.

To begin with, the project is based upon the assumption that a significant percentage of the average college course should be delivered using computer-based instruction. Most university courses, based upon lecture or discussion, are essentially an exchange of ideas between participants. Whether this exchange can be replaced by computerized activities is debatable. Artificial intelligence is not developed to degree where a computer can effectively replace an instructor as discussion leader. Much of the material described in lectures could be provided as computer text, but reading lecture notes hardly seems like something worth the trouble it takes to create them.

Today's computers are capable of providing more than just text, however. The LearnLink project plans to develop exciting lessons that use the full capabilities of the computer. Instructors are being encouraged to digitize pictures, sounds, and video, as well as text. But multimedia lesson development demands creativity on the part of the instructor. Many college instructors are unused to using non-text materials in their classes and they may be unsure how to effectively do so. Furthermore, very few college instructors will have the computer programming (or "authoring") skills necessary to computerize their class materials. Programmers need to be employed for course development. The process is time-consuming. It can all get quite expensive.

Furthermore, to use commercially available materials, copyright permission must be obtained. This requires further time and effort. At Kent State, librarians are being asked to assist in this process. Publishers can be very concerned about the dissemination of their materials online. Apparently, some have claimed that even printed material in textbooks already purchased by students for the class is subject to copyright clearance.

Multimedia files also require considerable computer memory and processing power. Used to any great extent, they may tax the capabilities of the equipment in the laboratory. In demonstrations of the LearnLink system that have used extremely large video files, there have been problems with machines crashing.

Another problem associated with the amount of processing required by large lesson files is sending them across a network. A considerable degree of bandwidth is necessary. The Kent State system local area network has its limitations, in this regard, as do the T-1 telecommunications lines used to send signals between campuses.

Distance education poses its own set of challenges. Students at remote sites typically find it more difficult to pay attention, ask questions, contribute to discussions, get assistance, and get to know the teacher (Tiene, 1997). Working with students at remote sites is problematic in the Distributive Learning system, for several reasons. In attempting to overcome these disadvantages, a system should provide as realistic a set of signals as possible from the teacher's classroom. However, in the Distributive Learning system, the compressed video signal is jerky and lips do not synchronize with sound when people talk. The audio part of the video signal is also on a delay. Students must wear headsets to hear it clearly. (In the teacher's classroom this becomes somewhat distracting, since the instructor's voice comes back in the headsets several seconds after the students actually hear it.)

There is another problem associated with assisting students at remote sites linked to Kent's Distributed Learning system. The LearnLink software does not yet enable the instructor to see student computer screens, except in "snapshot" still-frame form. This still frame can only be initiated by the student, using a different piece of software expressly for this purpose. In addition, the instructor cannot demonstrate educational software on the system, other than Toolbook files, since it cannot be processed by the LearnLink software that transmits data throughout the system. These capabilities are promised by ILink software developers in the near future. But, for now, these limitations have affected the way in which instruction can be delivered.

It is hoped that many faculty members will enthusiastically participate in the Distributed Learning project at Kent State University. So far, participants in the Pilot Project have been selected from applicants who are given a stipend to cover the extra preparatory time and effort associated with preparing course materials for the system. Whether future faculty will volunteer and whether monetary incentives will be necessary, remains to be seen.

It will be interesting to see if this project allows the university to expand its course offerings and increase enrollment. The cost-effectiveness of the project will depend largely on its doing so. If the LearnLink-based system for Distributed Learning is successful and is adopted by other universities, Kent may eventually be able to sell some of the courseware it has developed, as a pilot test site for the system. Hopefully, the system will live up to its potential and can provide a highly dynamic form of college level instruction across an entire section of the state of Ohio.

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General Session: Technology Implementation/Educational Reform

Evaluating a Challenge Grant: Linking Technology and the Arts With All Subject Area Learning

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Key Words: **project evaluation, grants, integration, arts**

Community Discovered is a five-year project that links technology and the visual arts with other subject areas to transform the education of K–12 students in Nebraska and nationwide. A special emphasis is serving rural and urban disadvantaged students. The focus of this project is to develop curriculum models of engaged student learning using technology and the resources of the Information SuperHighway. Five art museums are involved.

The project is being conducted by Westside Community Schools in Omaha, Nebraska, and the Nebraska Department of Education in Lincoln. The Community Discovered project has five goals: 1) to promote and encourage academic achievement, 2) to provide student equity in access to state and national museum resources, 3) to enable educators to effectively use appropriate technologies for teaching and learning, 4) to effectively integrate art into interdisciplinary curriculum projects, and 5) to create a national network of educators to support the development and implementation of appropriate learning strategies that integrate art and technology into other subject areas. The evaluation design is carefully matched to the project activities, and provides a five-year plan for both formative and summative review. The design of the evaluation for the Community Discovered Project is essentially that of an "impact analysis." In evaluation studies, impact analysis can be defined as "determining the extent to which one set of directed human activities affected the state of some objects or phenomena, and… determining why the effects were as large or small as they turned out to be" (Mohr, 1992, p.1). In this examination of the effectiveness of the Community Discovered Project, the evaluation design is focused on analyzing data related to each of the five goals, and related project objectives. The evaluation is determining the general impact of the project on K–12 education in the participating schools, and includes a careful examination of the learning environments for both students and teachers. The evaluation is also examining the potential use of the project as a model for replication by other educational institutions and organizations.

The evaluation plan emphasizes a blend of both quantitative and qualitative research methods and includes a comprehensive approach to data collection that is targeting information related to each goal and objective. These data types include 1) teacher survey data, 2) electronic data, such as listserv participation and electronic logs, 3) classroom observations and videotaping, 4) teacher and student interviews, 5) student projects and portfolios, 6) teacher growth plans, and 7) focus groups. All data is summarized and placed within a World Wide Web site, for review by project staff, participants, and interested stakeholders.

General Session: Technology Implementation/Educational Reform

What Helps in K–12 Technology Implementation: A Multi-State Regional Perspective

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Key Words: **Implementation, beginning, practices, policies**

Educational technologies have the capacity to help solve educational performance issues and regional and demographic disparities. Yet the potential positive impacts of educational technologies cannot be realized unless they are fully and effectively used in schools. These technologies are not self-implementing. They demand significant amounts of effort, at both individual and organizational levels, to successfully assimilate.

The Southern Technology Council[18] recently completed an 18-state NSF-funded study[19] on the process of K–12 technology implementation. Through surveys and interviews, the STC gathered information from over 200 exemplary schools on how they approach technological change and how they are impacted by governmental policies at all levels. The study focused on these areas:

Planning

A common first step in implementing educational technologies, there is a need for a process that includes vision, strategy, action steps, and milestones. We identified around 80 practices, 40 policy-practice linkages, and six sub-themes in this area. Leading-edge schools often make extensive use of planning committees to get input and buy in to their plan. A Maryland school and a New York district each created a two-pronged technology committee structure, with one group focusing on instruction and the other on infrastructure, with mandated coordination between the two.

Training

The implementation of new technologies demands users acquire new knowledge and skills. We identified around 120 practices, 50 policy-practice linkages, and five sub-themes in this area.

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[18] STC member states are: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia, West Virginia, and the Commonwealth of Puerto Rico.

[19] States participating in the study were Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Michigan, Mississippi, New York, North Carolina, Oklahoma, Oregon, South Carolina, Tennessee, Utah, Virginia, and West Virginia.

One of the strongest themes emerging from our interviews is that teachers overwhelmingly prefer peer-to-peer training. Teachers at a Georgia school took peer-to-peer training a step farther and decided two of their four required staff development "peer observations" should be on using technology in the classroom.

Technical Support

Educational technologies are not self-maintaining. Teachers need technical support help them realize the benefits. We identified around 70 practices, 30 policy-practice linkages, and five sub-themes in this area. Many, many schools create a building-level technology coordinator position by increasing class sizes slightly to free up a full teaching position devoted to technology. Technology-proficient students can also help. A school in Mississippi created a Guardian Angel technology program for students. When teachers have a problem they call out, "Do I have a Guardian Angel in here?" and a computer-adept student from the program comes to their aid.

Change Strategy

How do schools and districts get teachers, especially the fearful ones, to use these new technologies? Some schools adopt deliberate strategies, and we identified around 70 practices, 20 policy-practice linkages, and five sub-themes in this area. The STC found some schools go to great lengths to lessen the anxiety of technology-phobic teachers. A school in Oregon created a "buddy up" system where technology-illiterate teachers pair up with technology-literate teachers to learn how to use a computer and integrate it into their classroom.

Organizational Redesign

Technology implementation implies corresponding changes in organizational life, and we identified around 40 practices, 10 policy-practice linkages, and six sub-themes in this area. In fact, scheduling changes are frequently a by-product of a successful implementation process. One school in North Carolina "banks" extra time by starting earlier and ending later than other schools in the area. Every six weeks, they "spend" this extra time by having inservices during the afternoons of two early release days.

Leadership

Implementation of any complex technology involves an important role for informal or formal leadership. We identified around 30 practices, 10 policy-practice linkages, and four sub-themes in this area. Many of the leaders we identified exhibit reoccurring traits such as vision. One superintendent in Oklahoma educates legislators about educational technology's potential and tries to convert them into supporters by inviting legislators to conferences and briefings.

Resources

Educational technologies represent a significant cost in time and money. How schools, districts, and states address resources for technology is a major challenge. We identified around 100 practices, 70 policy-practice linkages, and seven sub-themes in this area. For example, reallocating existing resources is often a way to free up money for technology. The principal of a school in Michigan transformed a planned new school into a high-tech demonstration school without altering the bottom-line by making trade-offs. Among other things, he opted for a cheaper grade of carpet and eliminated student desks in favor of computer work tables.

STC Products and Dissemination Plans

The STC has created short, user-friendly descriptions of over 400 practices practitioners can replicate in their own settings and assembled them in a comprehensive 250-page guidebook. The guidebook also includes over 200 policy-practice linkages that describe the role policies can play in building-level implementation.[20]

To disseminate these results,[21] presentations are being made to every educational technology conference in the STC region, and up to 200 complimentary copies of the guidebook are distributed at each conference. The guidebook is also on the Southern Growth Policies Board/Southern Technology Council home page at <http://www.southern.org/edtech.htm>.

Copies of the guidebook "Making Technology Happen: Best Practices and Policies from Exemplary K–12 Schools" can be ordered for $10 each (pre-paid) from STC, P.O. Box 12293, Research Triangle Park, NC 27709, 919.941.5145, fax 919.541.5594, or e-mail <chansen@southern.org>.

General Session: New Curriculum Designs/Instructional Strategies

An International Videophone Language Program

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Key Words: **background, overview, participants, program, related activities, technology, summary**

An International Videophone Language Program

An important force in education today is the implementation of distance learning technology into existing and expanded curricula. The reach of satellite-based instruction extends present day academic capacities far beyond the school walls. With this technology becoming a norm in many schools, answering the problems of geographic isolation and specific staffing, a further extension of distance learning becomes apparent and possible. The original framework has been a link between a distance learning center (usually at a university) and a set of schools, wherein the primary flow of education emanates from the center to the classroom. Two other frameworks, growing out of the original center-classroom link can be structured. Taking the original program of learning as a result of working with the center, the school involved can, using appropriate technology, use that base for an extension linking their school and students to another school. A third structure can be a school to school distance learning program wherein schools teach each other.

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[20] There is also a shorter research report available separately analyzing the project's quantitative data.

[21] Funded in part by the Bell South Foundation; the Kenan Institute for Engineering, Technology & Science; and the members of the STC.

This model is an integration of all three approaches to distance learning, i.e. university center to school classroom, that classroom to another school, and internationally school to school.

The Model Overview

The International Videophone Language Program consists of three elements—ninth grade high school students of the Japanese language in Pennsylvania, first grade students in Minnesota, and Japanese students of the English language in Osaka, Japan. The program focuses upon the linking together of native-speaking language students nationally and internationally, cooperating in an integrated effort to master the basic concepts and conversational skills of the Japanese and English languages. Modern technology—the videophone, telecommunications, and faxes are the basic vehicles by which the program is carried out.

Participants

The following are the primary participants in the program:

- Mrs. Pam Solvie, first grade teacher at Morris Area Elementary School, Morris, Minnesota, and her 20 first grade students.
- Mr. Walt Tremer, high school Japanese language instructor, Southern Lehigh High School, Center Valley, PA, and his Japanese language students.
- Mrs. Yoko Takagi, English language instructor, Osaka, Japan, and her English language students.

The Program

The program framework is a structure of language interaction between students at the three locations, using the applicable technology. Each group fulfills specific roles in the overall program.

Mrs. Solvie's First Grade Class

First grade students study the basic elements of the Japanese language, instructed by Mr. Tremer's students. Each week, via videophone, Mr. Tremer's students conduct a lesson centering around Japanese vocabulary, grammar and written characters. Before each lesson, language worksheets are produced by Tremer's students, and faxed to the first graders, to be used in that week's lesson. Lesson plans include useful vocabulary (family members, classroom objects), expressions (age, greetings, likes and dislikes) and grammatical structures (subject-object, verbs, prefixes and suffixes). Reading and writing Japanese characters also is included. Several times the students send posters and other articles in Japanese related to their studies to the Pennsylvania students.

At least once a month, the first grade students then link with Mrs. Takagi's English students in Osaka, via videophone, where they practice their newly acquired language skills, as the Japanese students practice their English language skills.

Mr. Tremer's Japanese Students

Mr. Tremer's students study the Japanese language via satellite links, in a distance learning program. This knowledge is then used as a foundation from which to teach the Morris first graders. The Japanese language students prepare a weekly lesson on Japanese for the first grade students in Morris. Worksheets and lesson plans are faxed to the class and teacher, and a subsequent lesson is taught via videophone. Lessons center around the above-mentioned basic vocabulary, grammar and the writing of Japanese characters. On a monthly basis, Mr. Tremer's students link with Mrs. Takagi and her students in Osaka, to coordinate the lessons for the first graders, and practice their own Japanese skills.

Mrs. Takagi's English Language Students

The English language students in Osaka are linked at least twice a month with the American students in Minnesota and Pennsylvania, to jointly practice their English language skills. They also assist the American students in conversational skills and pronunciation.

Related Activities

While the primary focus of the program is the development of language skills, other areas of curriculum are drawn into the program. For example, Southern Lehigh High School students provide, via e-mail, a daily weather report to the Minnesota students, who are conducting a weather project, comparing Minnesota weather to that in Pennsylvania. The weather reports are sent in Japanese. Other curricular disciplines are drawn into the program. The program is also enhanced by exchanges of cultural materials between the students.

The Technology

The joint program uses modern technology—the videophone, telecommunications and faxes as a vehicle of instruction and communication. The videophone is particularly applicable for teaching of Japanese characters and vocabulary skills. The videophone is used to show pictures of objects related to vocabulary building, to introduce the students to each other, to show objects and scenes related to each others' culture, and other applicable usages. The three instructors link constantly, planning and coordinating the program via e-mail and fax.

Summary of the Model

Distance learning provides schools a vehicle with which to the expand their horizons in terms of curricula. With this as a foundation, schools themselves can in turn reach further out to other schools, sharing the learning experience. As shown in this model, the present technology can provide schools with a more active, participatory role in distance learning.

General Session: Society Session/Current/Emerging Technologies (Organized by CCSC)

Presentation Technologies for the Classroom

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Key Words: **presentation technology, information technology, pedagogy, multimedia, Internet**

As technology advances, a broader range of classroom pedagogical techniques becomes available. In this session, panelists will discuss the use of presentation technology in college classrooms. They will talk about their own experiences with the use of technology, what works best in helping students to learn better, what doesn't work and the types of classes to which presentation technologies can easily be adapted.

The discussion will cover technologies ranging from the ancient (blackboards) to the old (overhead projectors) to the cutting edge (computer projection, presentation software such as PowerPoint and Director, World Wide Web pages, Java, satellite broadcasts). Modern versions of older technologies will be surveyed together with new tools only made possible by recent advances.

The advantages and disadvantages of the tools will be considered. (The panelists are not all necessarily in agreement with regard to the maximal use of the newest technologies.) Points to be discussed include cost, the ability of students to "parse the screen" when too much information is flashed by, the learning curve for instructors, etc.

Issues tangential yet related to presentation technology will also be discussed. For instance the panel will consider how the presence of computers in the classroom affects student attentiveness and how they might be best arranged to mitigate any problems. The extent to which information technology such as e-mail and the Web improves communication between teachers and their students, improves the writing skills of students, and helps to keep them updated about their classes are other important topics to be covered.

Internet Poster Session

Encarta Schoolhouse

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Key Words: **Encarta, Schoolhouse, resources, Internet, online, lessons, activities, lesson plans**

Abstract

Encarta Schoolhouse (http://encarta.msn.com/schoolhouse/) offers rich content and helps teachers find relevant Internet resources for homework, research projects, and lesson plans, while encouraging collaborative, interactive learning.

Microsoft's Encarta Schoolhouse is a place for students and educators to explore the rich content of Microsoft reference products, as well as access new online resources for an interactive learning experience.

Designed primarily for students and teachers in grades 5 to 12, Encarta Schoolhouse explores in-depth monthly topics relevant to subject areas taught in American schools, such as Endangered Species, Women in Science, Native Americans, Life in the Ocean, the Olympic Games, the American Civil War, and more. With each featured topic you will find compelling Encarta Encyclopedia text and media, selected links to sources on the Internet, engaging learning activities, and a notable subject expert available online to answer your questions. Encarta Schoolhouse also provides an area for educators to share ideas.

This presentation demonstrates key features of Encarta Schoolhouse including Topic-of-the-Month, Ask an Expert, Learning Activities, Teacher Bulletins, and the new Encarta Lessons Collection, a resource of lesson plans for teachers.

Traditional Poster Session

The Role of the CD-ROM Encyclopedia in Student Research

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Key Words: **Encarta, student research, research, writing project, citation, outlining**

Abstract

We provide tips on using Microsoft Encarta for student research and writing projects, including proper citation procedures, systematic information gathering methods and effective outlining techniques.

Teachers often direct their students to encyclopedias as a starting point for research projects and reports, and follow up with assignments to track down additional resources. The search features and multimedia content of CD-ROM encyclopedias make them ideal as a starting point, but can they be used for researching additional sources as well? In this presentation, we describe features of Microsoft Encarta Encyclopedia, which address this latter purpose. We illustrate some innovative examples of classroom usage that help students to define their topic more clearly, identify relevant resources in books, periodicals and Internet Web sites, and organize their ideas more effectively. In addition, we discuss the important questions of the role of electronic tools in assisting student research and the proper use of digital media in the classroom.

General Session: Exhibitor Presentation/New Curriculum Designs/Instructional Strategies

Technology and Inclusion: A Great "Team" for Students With Special Needs

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Key Words: **Edmark, special needs, inclusion, educational software, educational technology**

Combine a staff, classroom and school committed to successful inclusion, with sensitively designed, uniquely creative and adaptable, educationally sound software and students with a variety of special needs can be successful in reaching their individual goals. Within Edmark educational software programs are many features that allow educators to adapt and adjust programs to individualize them for student success. These specific software features and the benefits derived from them, allow the inclusive setting to be maximized and also provide benefits for all students in the classroom.

The presenter will show software in the areas of early learning, interactive creative writing, thinking skills development, math and strategy skills and will cover kindergarten through eighth grade.

Students with learning disabilities, limited English proficiency, language delays, moderate visual and auditory limitations, and students with physical, social, mental, or emotional concerns will be addressed in reference to specific software use.

Some programs from each of the following Series will be shown and their features and benefits identified in relation to some specific types of learning problems.

Early Learning Series—Millie's Math House, Bailey's Book House, Sammy's Science House, Trudy's Time & Place House, Stanley's Sticker Stories features

- Specifically identified age groups with appropriate learning goals and friendly interface
- Positive gentle feedback, guidance and natural prompts in Explore and Discover and Question and Answer modes
- High-quality speech, including many children's voices
- Visual clarity, visual cueing and large active response areas on-screen
- Built-in scanning for single switch users and compatible with alternate input systems
- Friendly interface for students with varying abilities/disabilities
- Teacher tools

Imagination Express Series—Destinations: Neighborhood, Castles, Rain Forest, Oceans, Pyramids, Time Trip, USA, features

- Curriculum/skills development opportunities
- Flexibility for the school environment
- Settings for levels, grade, ability/disability
- High interest destinations

Thinkin' Things Series—Thinkin' Things Collection 1, Thinkin' Things Collection 2, Thinkin' Things Collection 3 features

- Wide range of thinking skills activities
- Visual and auditory memory activities
- Many non-language learning opportunities
- Create and Question and Answer modes have encouraging prompts that lead to student success
- Built in scanning for single switch users and compatible with other alternate input systems

Mighty Math Series—Carnival Countdown, Zoo Zillions, Number Heroes, Calculating Crew, Cosmic Geometry features

- Strong curriculum-based math content for specifically identified grade levels (K–10th grade)
- Flexible settings, Grow Slides, concrete and abstract learning opportunities
- Virtual Manipulatives, an innovative educational technology from Edmark
- Options for alternate access

Strategy Series—Strategy Challenges Collection 1, Strategy Challenges Collection 2 features

- Games specifically chosen to meet educational goals
- Instruction and coaching on multiple levels
- Player options

Workshop

Live Cams Exhibit Student Learning

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Key Words: **Live Cams, Internet, culture, countries, learning, visual literacy, stereotypes**

Abstract

Students can learn much from using Live Cams (cameras on the Internet); many of these cameras offer pictures taken from the last 24 hours up to this moment. As you explore several of the many Live Cams sites, you will discover the various Live Cam topics from many countries and parts of the USA such as geography, historical places, street scenes, beaches, etc. Your students can develop their visual literacy skills as they use Live Cam visual clues to learn information about a place in another country or the USA. You will hear of Live Cam based activities in many subject levels at many grade levels. The students learn your subject area content and the culture of the other countries at the same time! For example, students can practice their math skills while analyzing the types of traffic in another country. Your Internet explorers will end up learning both math graphing and cultural traffic information. You'll be amazed at how current Live Cam images can not only convey present day cultural information but help students to overcome many stereotypes of people and places in other countries. You will design additional activities to help you incorporate this communication tool into your classroom. We will review how students can use Live Cam images in multimedia or "writing" projects. We will go over some classroom management issues in using Live Cams Internet learning.

Then we will see how to set up a Live Cam to demonstrate learning. We'll discuss what software and hardware you need and where you can get these things for about $200. More importantly, we talk about what Live Cam "sights" are worth sharing with others. We will talk about how your students can share their insights with others!

General Session: New Curriculum Designs/Instructional Strategies

Technology Tag Team: A New Method for Training Teachers and Integrating Technology in the Curriculum

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Key Words: **training, staff development, mentoring, integrating technology in the curriculum**

Teachers must see how technology can support the curriculum and visualize themselves as successful technologies users before students will have true technology integration in their learning. Jessamine and Scott Counties in Kentucky have implemented a TAG team to make this happen. In typical situations in takes from three to five years to integrate for teachers to feel comfortable enough with technology to integrate it into the curriculum.

Using the TAG team concept of one teacher mentoring others the time is reduced to less than 18 months! The TAG team concept uses the idea of "Just in time learning." Training available when the person is ready for it not just when it is convenient to schedule. Research already has shown that teachers learn best by planning and working collaboratively.

We will share a model that is working in Kentucky. This model allows for great student achievement and encourages principal and district support.

A Web site has been developed to share information with other teachers. The potential benefits are staggering for teachers to have the ability for automatic uploading and downloading of appropriate technology rich lesson plans.

URLs

Jessamine County Research Manual: Technology Integration Curriculum—
http://www.jessamine.k12.ky.us/research/Research.html

Tips and Tricks for Mentors—
http://www.jessamine.k12.ky.us/jcbo/tipstricks.html

Jessamine/Scott Counties Technology Competencies:
http://www.scott.k12.ky.us/project/main.html

Jefferson County Public Schools, Jefferson, Colorado: Jeffco Online
http://jeffco.k12.co.us/di/jeffco.html

Alaska Department of Education
http://www.educ.state.ak.us/hs/technology.html

FromNowOn.Org
http://fromnowon.org

General Session: New Curriculum Designs/Instructional Strategies

Success With Keyboarding

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Key Words: **keyboarding, typing**

Success With Keyboarding is a modern scientific way of teaching typing. It has been used in Kentucky with students ages nine through adult. *Success With Keyboarding* uses psychoeducational principles related to what we know about how students learn. Boredom is minimized and time on task and learning motivation maximized. Originally, it did take months to learn how to type, but now only approximately 10 lessons.

Teachers have found that teaching writing through using word processing produces students who are more willing to edit what they write; therefore, the student that does not know how to keyboard/touch type is at a disadvantage. *Success With Keyboarding* removes that disadvantage in a very short time! One of the authors failed typing with traditional methods and therefore looked for other, more successful, ways of teaching students. Beginning with the very first session it should prove to be a rewarding and enjoyable experience for you and your students. There is nothing new here in terms of the keyboard, letters, numbers, the need for practice, etc. The new "success" of *Successful Keyboarding* lies in a creative application of a set of procedures already known to be effective in other educational methodologies. The following are examples based on the research and experience of the authors, an educator and school psychologist.

Instead of beginning to teach keyboarding with the eight home keys (*asdfjkl;*), as do most keyboarding methods, this approach teaches students in an **A-TO-Z order** and shows them **how to "chunk"** (group) keys together for more efficient remembering. This way, instead of the learning being totally new, disconnected to previous knowledge, a sequence is used with which students are already familiar.

Before beginning to teach keyboarding, **cover all the home keys (*asdfjkl;*) with moleskin**, available at the local drug store. The benefit of using moleskin is that it is sticky on one side and fuzzy on the other, making it easier to locate the home keys without looking. All the other letters, period, and comma are covered with plain paper labels. This makes certain the students truly use touch typing. In many methods, the teacher must continually remind students not to look at their fingers; covering the keys removes this need.

Students with weak fine motor skills or eye-hand coordination **may need to continue to watch their fingers** to monitor that they move to the correct keys, but this behavior will fade over time. Students with fine motor difficulties may have problems *keeping* and *returning* all the appropriate fingers to the home keys. Tell them to at least keep their ***d*** and ***k*** fingers on the appropriate keys and, with the help of the moleskin, they can find their way back to the home keys.

There are five components to each daily lesson: 1) collection and assignment of home practice, 2) review, 3) introduction of new Keys and concepts, 4) directed practice, and 5) homework. As with most skills, the best way to improve typing is by typing. This approach offers a positive, research-based structure to that process.

General Session: Society Session/Technology Implementation/Educational Reform
(Organized by ISTE's SIGTC)

Organizational Do's and Don'ts for Connecting to the Internet

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Key Words: **Internet, policy issues, administrative issues**

Description for Program

So you're going to get a direct connect to the Internet. What do you do now? How do you prepare technically for your campus-wide network? How do you prepare appropriate policies and procedures? What are the human resource and legal issues you need to consider? This session will help you to set your course for smooth sailing on the Information Highway.

Target Audience

Administrators or person in charge of developing and implementing a direct connection to the Internet in their organization

General Session: New Curriculum Designs/Instructional Strategies

Classroom FeederWatch: Students and Scientists Working Together

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Key Words: **telecommunications, student-scientist partnership, standards-based instruction**

Presentation Summary

Because ornithologists cannot be everywhere all of the time, they depend on amateurs to help them collect the data they need for their research. Classroom FeederWatch, an interdisciplinary science curriculum developed by the Cornell Lab of Ornithology (Lab) and TERC with funding from the National Science Foundation, gives students in grades 5–8 the opportunity to join this partnership and to experience the excitement of scientific research right in their classrooms.

A brief description of the underlying principles that shape the Classroom FeederWatch curriculum will focus the presentation. These principles are listed below:

- Students are amateur ornithologists.
- Students contribute their data to a research database.
- Students share their data with other student ornithologists, analyze those data, and use their findings to describe how the natural world works.
- Professional ornithologists use student-generated data in combination with other data in pursuit of their professional interests.

Field-test data will be used to demonstrate how students set up feeders in their schoolyard, learn to identify and count the kinds and numbers of birds that visit them, and share their data on a network with scientists at the Lab and with other students doing the project. The presentation will use software designed for the curriculum to show that the project enables students to probe their own research questions and questions of interest to ornithologists, to publish their research in a science newsletter, and to extend their studies into new and different areas.

In summary, members of the audience will discover how Classroom FeederWatch enables students to learn in many ways; they become environmentally aware; they develop content knowledge about bird anatomy, physiology, and behavior; they experience scientific research as a process of questioning, testing, analyzing, and re-questioning; and they consider the importance of accurate communication. Interdisciplinary connections include mathematics, art, geography, language arts, social studies, and computer science.

Traditional Poster Session

Introducing CLEO!

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Key Words: **inquiry, science, telecommunications, collaboration, Web publishing**

Building on 10 years of experience with inquiry science and technology, TERC has designed a new generation of teacher-friendly Internet tools for the classroom. Collaborative Learning Environments Online (CLEO) is a space on the Web where teachers and students design and publish inquiry projects in science and mathematics.

BROWSE the Library

CLEO is the home for a library of data-rich inquiry projects from classrooms across the country. In this Browse area, viewers can read each project, review its experimental data and contribute to a discussion of the findings of that project.

PARTICIPATE in a Collaborative Project

Classrooms review a list of collaborative projects that are looking for participants. After they enroll, they conduct that experiment in their classroom and contribute their data to the shared database. Later they work with the project's other collaborators to develop the analysis of the findings.

AUTHOR a Project

CLEO provides participants with the tools they need to create a new data-rich project. These can involve collaborations among classrooms or they can be designed and implemented by a single classroom. Authors define a database on the CLEO server, describe the data collection procedures, enter and analyze the data, and moderate a discussion of the results.

Any individual or classroom with a Web browser can be an author. Authors create CLEO projects by simply filling out forms that describe the project and construct the table that will hold the data. Visitors navigate the project on a series of friendly Web pages that include the research question, materials and procedures, the data of the study, and the authors' analysis and conclusions about their findings.

Data from any CLEO project can be analyzed locally by downloading it into a spreadsheet or graphing program on your hard drive. CLEO does not require any special software other than an Internet browser. Authors and participants in CLEO projects need no special skills in Web page design.

CLEO offers teachers, students, and curriculum developers a forum for making classroom activities collaborative and public. It can serve as an online science journal for students and a place where classroom scientists can find others with similar research interests. And it is a library of classroom projects that really work.

You can reach CLEO on our Web page.

http://teaparty.terc.edu/CLEO

General Session: New Organizational Structures

Leveraging Resources for Fiber Networking

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Key Words: **fiber optics, networking, partnerships, intergovernmental, funding, economic development, schools**

Instead of competing, schools, county and local governments, private economic interests and a People's Utility District came together with a unique vision and creative financing to develop a fiber optic network to meet both public and private needs.

It began at the Central Lincoln People's Utility District. The PUD is a non-profit publicly owned electric utility serving approximately 35,000 customers on the central Oregon coast.

In 1992, an FCC ruling mandated major changes to the utility communications system. The decision was made to enter the fiber optics arena considered by the PUD to be the technology of the future. A vision of local fiber optic networks, combined with a new SONET digital microwave system, would allow the PUD to connect all of its offices and facilities such as sub-stations and switching sites.

The decision to make a major investment in a hybrid fiber-microwave network was driven by the knowledge that de-regulation was in the electrical industry's future and the PUD would need to improve reliability and customer service.

In 1993, key community leaders, meeting with the PUD, recognized an opportunity to provide readily available and affordable access to the information highway for schools, libraries, hospitals and local government entities. Meetings were held on a monthly basis to discuss the needs and potential for a coastal communications network to provide high speed access to a rural area encompassing parts of three counties, roughly 2,000 square miles. These initial meetings led to the formation of CoastNet, a public/private alliance dedicated to providing high speed service to the area. The building of this highway led to the potential for public access and economic development in the private sector. In 1995, the PUD passed a board resolution dedicating a portion of its "engineered reserve capacity" to economic development in its service area.

As the PUD planned its network across their service area to better manage electrical usage, it became clear that a system with reserve capacity needed to be built. Engineering studies for the long term needs for the PUD showed that a system 10 times the capacity needed could be built with only a 10% increase in cost. This "engineered reserve capacity" could be made available to local government agencies including schools.

Thirty-seven agencies representing K–12 education, higher education, libraries, small local governmental entities and county government formed a governance board (CoastNet) to create an umbrella to apply for grants. Lincoln County School District acts as the fiscal agent for grant management. The PUD, through intergovernmental agreement, owns the equipment purchased through grants, and CoastNet will manage private access to the system.

Funding opportunities took several different directions. One of Lincoln County's economic development goals is to enhance technology related jobs by providing high speed communication access. At the state level, lottery monies were available for regional economic development that required matching funds. The PUD's investment in its infrastructure and the school district's investment in technology created a match that resulted in two grants.

$150,000 in state economic development funds for regional strategies were granted to provide hubs, routers, and switches for key locations within the community. Another $150,000 in multi-region economic development funds were granted to provide additional hubs, routers, and switches to expand into two other counties. These grants assist in providing a standard for compatibility throughout the fiber network. The PUD's first user of the network is Lincoln County School District.

The network provides increased speed and capacity at a low cost. At this time, a high school, a middle school, two elementary schools, an alternative school, and two district offices are connected to this network which provides Internet, e-mail and Intranet administrative network connectivity. To take advantage of this capacity, private sources such as US West Foundation, Meyer Memorial Trust, and local donations from small businesses and service organizations contributed over $100,000 to support the schools' local area network.

What has this meant and what will it mean for our area? K–12 and community college students gain access to Internet and e-mail to enhance learning. Public libraries will provide access for community members.

Our rural "virtual" community will improve the quality of its health services through better access to and transfer of health related information. Small businesses will be attracted to an affordable access to the information superhighway, making them competitive with their urban counterparts. In the future, communications will expand to include multiple broadband digital services, point to multi-point video distance learning, videoconferencing and high speed data transfer.

General Session: Technology Implementation/Educational Reform

Teaching and Learning Collaborative (TLC) in Technology

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Key Words: **teacher education, inservice development, preservice development, technology applications, e-mail**

Overview of the Project

The Teaching and Learning Collaborative (TLC) in Technology, created as a partnership between William Paterson College of New Jersey and Lakeland Regional High School District, has three goals: (1) to prepare teacher education students for using technology in their academic disciplines; (2) to support the professional development of cooperating teachers; and (3) to help pre-college students enter college with increased knowledge of a discipline because of the benefits of technology. Immersion, guided mentoring, and collaborative supervision provide the framework for accomplishing these goals.

Students seeking secondary education certification spent an entire year (the first semester for practicum and the second semester for student teaching) with one cooperating teacher and one college supervisor. Each student teacher/cooperating teacher/college supervisor triad created a collaborative community for teaching and learning about technology by (1) participating in whole-group sessions, special workshops, and seminars; (2) communicating electronically with each other; (3) keeping an electronic journal to self-reflect about their use of technology; (4) taking a one-credit course, Technology in the Secondary Classroom, to learn about ways in which to integrate the various technologies into the academic disciplines; and (5) creating technology-embedded content lessons that were team taught.

Two different technology educators from the college were responsible for teaching the course at the high school and facilitating the seminars there. The first technology educator, hired for the Fall semester, helped participants to understand basic uses of technology in the content areas. The second technology educator, hired for the Spring semester, used the groundwork laid during the first semester to get participants to create lessons that included technology. In addition to teaching the course and facilitating the seminars, the second technology educator used e-mail to communicate frequently to all participants.

E-mail also was used to help students have in depth conversations about the elements of good teaching, develop lesson plans, and enhance instruction. Students sent lesson plans electronically to college supervisors and cooperating teachers prior to implementation. College supervisors sent back electronically suggestions to preservice teachers (that were copied to cooperating teachers) for refining lesson plans and then preservice teachers implemented the lessons before a second round of self-reflective pedagogical thinking took place.

Overview of the Presentation

This general session will report on the variables that need to be in place to pilot such a program and the outcomes of this yearlong project. Questions such as: Do cooperating teachers actually use technology more frequently and effectively in their content classrooms? If so, what types of skills, attitudes, and experiences do cooperating teachers need to bring to such a project? Do secondary education students have a better understanding of how to integrate technology into their academic disciplines? Are high school students more enthused about a particular content area because of their experiences in using technology? Do triads have more frequent and open conversations about pedagogical issues because of their access to electronic communication?

The panelists, representatives from the college and the school district, will demonstrate some of the projects created as they share an analysis of each triad's experiences and highlight some of the findings from the electronic communication analysis. Recommendations for making significant connections between the K–12 and higher education environments will be provided as part of a packet of material that offers ideas and issues emerging from this project.

General Session: Technology Implementation/Educational Reform

The Implementation of School-Based Inservice That Works

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Key Words: elementary, site-based, professional development, multimedia, telecommunications

The need for continued professional development of teachers is quite compelling. In this project, we report on the development and validation of a professional development model for integrating technology into elementary science and mathematics instruction. The professional development model was designed to be aligned with the most recent recommendations for effective professional development (NCTM, 1989; 1991; AAAS, 1990; 1993; NRC, 1994). For example, NCTM (1991) prescribes hands-on, student-centered teaching and authentic, performance-based, instruction-driven assessment procedures as necessary components of effective instruction in mathematics. The appropriate application of technology provides a viable means to assist in achieving changes that more closely meet these instructional mandates. The project, a collaboration of a College of Education and a Southwestern school district, was funded by a National Eisenhower Grant.

One hundred and two teachers from four elementary schools with high minority enrollments participated in one of three phases of a professional development program. During the first year, 54 teachers from two schools participated. In the second and third years, the professional development program was revised and another school was added each year. In the first year, Cohort I teachers participated in 18 three-hour sessions conducted on a weekly basis after school during the school year and a 10-day intensive summer session. The second year of the project, Cohort I teachers received training in nine three-hour weekly sessions and a 5-day summer session. In the third year of the project, these teachers participated in seven 2.5 hour workshops and 15 hours of online activities. The Cohort II teachers participated in the project for two years and the Cohort III teachers participated only for the last year. First-year workshop topics included: setting up the hardware including a Mac AV computer with display, LaserDisc player, and 27" monitor/receiver; loading software; using word processing, spread sheets, and data bases; using production software such as Kid Pix and HyperStudio; using LaserDiscs; etc. During the school-year sessions, instruction in a topic and opportunity for individual practice was provided. Then teachers were expected to use the newest information/techniques in their classrooms and report at the next session on the successes and challenges they had encountered with the use of the information/material. In the second year, teachers developed an integrated thematic unit and further developed their knowledge of computer applications including digitizing video, and troubleshooting of software and hardware. The third year, each classroom received Internet and e-mail access. Teachers learned to integrate the Web in research projects and refine classroom organization procedures providing support for project oriented learning.

Data were collected from the participants during the school year and summer training through surveys, teacher interviews, and teacher journals. An analysis of the data revealed that teachers expressed initially low levels of implementation and little confidence in their ability to teach using computer and multimedia materials. As teachers became more familiar and confident with computer and multimedia technology use through instruction and implementation, their classroom use and confidence levels increased. Although the participating teachers initially demonstrated minimal computer competency, they were able, by the middle of the second year, to fully engage their students in fairly sophisticated levels of learning by means of technology (e.g., problem identification, research, report generation, and presentation). Further, by the end of the third year, the integration of technology into instruction precipitated change in teachers' instructional approaches in science and mathematics. The presenters will share their CD-ROM and/or videotape to bring to life technology enriched practices demonstrating teachers using small group work, independent research, and student-directed problem solving. Also, the presenters will share thematic units teachers developed integrating technology in science and mathematics. These units are available through our Web site:

http://www.west.asu.edu/kwetzel/title.html.

Moving Schooling From Knowledge Reproduction to Knowledge Building

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Key Words: **knowledge building, LAN, CSILE, community learning**

> *"Schools have been places where students watch teachers work. Schools need to become places where students become knowledge workers. Therefore schools need to work on the work they give students to do."*
>
> *—Phil Schlecty, Center for Leadership in School Reform*

Since 1994 the Jefferson County Public Schools (Louisville, KY) have been using LAN technology to transform the work they give students. Teachers have been transforming classrooms into learning communities where students work to build their knowledge and advance their individual and collective understanding. The technology that is enabling this transformation is CSILE, Computer Supported Intentional Learning Environments.

CSILE is a LAN software system specially designed to change the classroom culture into one in which understanding is the focus of schooling. CSILE has been developed since 1986 by a team of cognitive researchers and computer scientists led by Marlene Scardamalia and Carl Bereiter at the Ontario Institute for Studies in Education in Toronto, Canada. Making understanding the central focus of schooling is a qualitatively different, and more powerful, kind of work than that of information access which is much in vogue and has been the main focus of the educational use of the Internet.

Using CSILE, students from 4–8 classes work to contribute knowledge, in the form of graphic and text notes, to a communal database which represents the community's emerging knowledge. In these notes students formulate their own problems of understanding and pursue them in a progressive manner, identifying the new learning they discover in their learning journey. Students are expected to write a "Reflection," as they reach new vistas of understanding. They are also expected to become part of a discourse community, commenting on and contributing to the work of other students through notes which provide probing questions, ideas for additional knowledge resources, or by linking a student's note to other related notes which enrich its context.

In JCPS, 16 teams of teachers, representing 61 classrooms in 14 schools, elementary to high school, with 1,200 students ranging from upper middle class to poor have been participating. Teachers at all grade levels and with all socio-economic levels report that students are more engaged in their learning and their school work. Student work demonstrates increases in depth of understanding, "voice," ability to formulate problems of understanding and develop and pursue learning plans. Parents report that their children are more engaged with school and with their learning.

Join us to hear about:

- the extensive research on CSILE;
- classroom teachers reports on its practical application in the classrooms; and
- district implementation strategies.

Internet Poster Session

To Infinity and Beyond... Exploring NASA's Electronic Resources for Educators

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Key Words: **NASA, Internet, distance learning, interactive, videoconferencing, multimedia**

Abstract

A NASA representative will demonstrate how to access the Agency's electronic resources designed specifically for educators. Participants will venture through cyberspace to NASA's Education homepage and other NASA sponsored projects. They will search NASA SpaceLink to obtain the latest NASA curriculum support materials to enhance their classroom. The Sharing NASA with Our Classrooms project will be explored—a site where teachers and students interact online with NASA scientists and researchers. Other educational Internet projects like KidSat, which provides students the opportunity to take pictures from space with a camera remotely controlled onboard the Space Shuttle will be highlighted.

Participating educators will be introduced to *On the Cutting Edge*, NASA's live satellite videoconference series featuring astronauts, scientists, and researchers. Multimedia products like the *Lift Off* to *Learning Videotape Series* featuring NASA astronauts explaining the mathematics, science, and technology concepts which make spaceflight possible will be reviewed. The group will also learn how to obtain NASA interactive educational CD-ROMs and software such as the Astronomy Village.

Related URLs

NASA Education Homepage:
http://www.hq.nasa.gov/office/codef/education/

A Guide To NASA Education Programs:
http://ednet.gsfc.nasa.gov/nep/programs/

NASA Spacelink:
http://spacelink.msfc.nasa.gov/

NASA's K–12 Internet Initiative:
http://quest.arc.nasa.gov/

NASA's Classroom of the Future:
http://www.cotf.edu/

NASA CORE:
http://spacelink.msfc.nasa.gov/CORE

NASA Educational VideoConference:
http://www.okstate.edu/aesp/VC.htm

Shuttle Amateur Radio Experiment:
http://www.nasa.gov/sarex/sarex.html

Aerospace Education Services Program:
http://www.okstate.edu/aesp/AESP.html

The NASA Homepage:
http://www.nasa.gov/

General Session: Exhibitor Presentation/New Curriculum Designs/Instructional Strategies

MP Express™: Multimedia Power Without the Complications or Cost

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Key Words: **MP Express™, multimedia**

Description

Presentation tools are great for learning but how much time do students spend learning the software? Where do they find the pictures, videos, sounds and music? Come see the new MP Express™ CD-ROMs that sell for under $50 a kit (Mac and Windows).

MP Express™: Multimedia Power Without the Complications or Cost

Gone are the days when kids would labor for hours cutting out pictures, drawing and coloring titles and making large cardboard displays. Today, children can easily create multimedia presentations using pictures and movies from around the world and they can do it using the most popular medium of all—television. But, is this really the case?

Many teachers despair at engaging students in multimedia projects for a variety of reasons. The presentation software is typically expensive. Most software has far more capability and complexity than the students need or can manage. The software may include a variety of picture, video and sound resources but no particular topic is covered to any depth. The obstacles mount quickly and the prospect of really taking advantage of the motivating power that multimedia offers begins to diminish.

For the past year, Bytes of Learning and Digital River Inc. have cooperatively developed a new series of CD-ROM based multimedia presentation kits. The first of this series is called On the Brink™.

Each kit in the series contains a multimedia presentation program called MP Express™. This complete presentation tool is so structured and easy-to-use that it minimizes the time students take to learn its use. The design of the program is inspired by classroom based educational research conducted over the past several years. The research specifically aimed to address the technical obstacles presented by most multimedia presentation software and to develop a program that would be better suited to the unique needs of the classroom.

Each kit also contains a thematically organized and in-depth collection of multimedia resources. All of the resources are categorized and pictorially arranged so students can browse and pick what they want for a particular topic or presentation. For example, On the Brink focuses on endangered species and habitats of North America. It includes pictures, movies, and sound effects for 56 mammals and birds. It also includes pictures of habitats and land use along with musical scores—all ready to use.

MP Express™ enables students to create their own narrated TV documentaries in minutes. The simplicity of the program and the immediate availability of resources make it possible for students to spend the bulk of their time on the real purposes at hand. These include learning about the topic, writing, discussing, and co-operating with other students. Less time is spent on figuring out how to run software and more is spent on the real business at hand.

Bytes of Learning has addressed the final obstacle—price—by offering each MP Express™ kit at an incredible price of $49.95, 5-station lab packs at $144 and 30-station site license packs at $495.

In this presentation, Bytes of Learning and Digital River will present the MP Express™ software and the On the Brink™ production kit. They will share the results of beta testing in schools and they will share suggested techniques for using the kits in the classroom. The companies will also share their plans for establishing a resource pool on the Web so students can access an even wider variety of information.

This presentation will be of particular interest to educators who empower their students with multimedia tools for learning. The software is for Macintosh, Windows 3.1, and Windows 95.

Paper Session

Dynamic Blueprint for Technology Integration: Evolving Structure, Construction, and Prototypes

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Key Words: **Integration, preservice, technology, curriculum, plan, case**

Abstract

This paper presents a case study of technology integration with faculty as architects of evolving structures and engineers of authentic activities for preservice teachers. The report uses a metaphor from architecture to describe the goals, the curriculum, and the processes used for implementation. Prototype projects are described and the INUS Explanation is used to relate the factors that seemed to contribute to the success of the technology integration effort.

Introduction

> *"Blueprint: A copy of an original diagram or plan, used as a working drawing/a detailed plan for achieving some large undertaking" (New Webster's Dictionary, Vol. 1, p. 39–40).*

The world is full of architectural structures that give testimony to formal planning and design. The Pyramids, The Hanging Gardens of Babylon, The Taj Mahal, Eiffel Tower, and Empire State Building are models of precision and symmetry, suggesting unassailable engineering principles and patterns. Yet in almost every instance, these structures "would have been preceded by dozens of sketches and diagrams as the architect's thought developed from an initial conception of the building to the final solution... such studies document the process of design" (Kostof, p. 4). Within architectural history, however, scholars have largely ignored the emergent processes of design and concentrated on the visible product or the final blueprint as evidence of "The Plan." This notion of fixed principles so influenced the art and method of architecture that "not until the late 18th century did Greek and Roman architecture cease to be the unassailable criterion of excellence throughout the Western World" (p. 1).

This same emphasis on Greek and Roman patterns of education as the epitome of excellence was accepted as the absolute curricular blueprint until challenged by progressive educators such as Rousseau and Dewey. Today, constructivist philosophy advocates that learners construct knowledge by solving reality-based problems and operate within their personal worlds, facilitated by a teacher guide instead of directly receiving information from expert teachers. A constructivist blueprint for curriculum values the process as well as the product, while recognizing the need for experimentation and motivation. Because constructivist education involves authentic activities, technology can merge both innovative tools and instructional procedures. Nevertheless, Roblyer et al. (1997) asserts that, "The most modern of these tools, electronic and computer-based ones, seem to present the most difficulty for teachers learning how to use them and integrate them into teaching" (p. 5). Educators are often left feeling confused and overwhelmed by technology that has been largely focused on students and is constantly changing. Yet Hill & Sommers (1996) assert that, "Technology ranging from electronic presentations to adaptive devices must be part of teachers' repertoire in the high-performance schools necessary to prepare students for a technological world" (p. 300). Obviously, faculty and students in Schools or Colleges of Education have a great deal of work to do if they are to prepare preservice teachers to meet these challenges.

This paper reports a case study that examines the process of integrating technology into every course of the teacher education preparation programs for elementary and secondary certification at a medium-sized, liberal arts university. This single case is couched within an architectural metaphor to facilitate a more succinct explication of the salient features of the study. The blueprint for this integration endeavor is described as dynamic because, like an architect's progressive notes, it requires enough structure to function as a working base while retaining enough flexibility to adapt to the constantly changing face and application of technology. This flexibility is also a vital part of the construction of the 266 students' knowledge, the actual technological projects within each course, and the knowledge base and comfort level of the 12 instructors. Finally, the evolutionary nature of this dynamic requires the careful examination of the models or prototypes of such a curriculum, so that the structure remains true to the intent.

Evolving Structure

In the first century AD, the Roman architect Vitruvius declared that "architecture was a building that incorporated 'utilitas, firmitas, and venustas,' which Sir Henry Wotton translated in the 17th century into the English "commodotie, firmness, and delighte'" (The 1996 Grolier Multimedia Encyclopedia, p. 1). Wotton's translation recognizes that architecture must have utilitarian qualities (commodotie), structural stability and soundness (firmness), and attractive appearance (delighte). As our faculty struggled with revamping a typical four-year education program into a more progressive and technologically adept one, the image of the structure we wished to build was influenced by the general university's goal of a computer-intensive environment as well as the stated five-year goal of the School of Education, "Faculty and students will use technology to explore, understand, research, create, apply, produce, and exchange knowledge" (School of Education Faculty Handbook, p. 1).

Approaches to technological proficiency for K–12 teachers abound (Lillie, Hannum, & Stuck, 1989; Merrill, Hammons, Tolman, Christensen, Vincent, & Reynolds, 1992; Forcier, 1996; Jonassen, 1996). Major differences in these approaches seem to be in organizational strategies rather than technical skills necessary for effectiveness. Stakenas, Tishkin, and Resnick (1992) report four generic areas of technical skills that are consistently recognized—equipment operations, productivity tools, instructional applications, management applications. Moreover, Rodriquez (1996) in offering planning and instructional strategies for enabling preservice teachers to achieve desired technology competencies, suggests that university faculty begin by reaching consensus about which proficiencies are to be targeted. Within this context, then, our faculty sought to develop specific goals that would address both the scope and sequence of technology integration—the vision of a structure that would be *utilitarian* in preparing teachers for a futuristic classroom, exhibit educational *soundness* supported by research, and be *attractive* to both students and teachers as a learning community. The following goals may be seen as the building specifications in that design:

1. Students will observe the modeling of appropriate uses of technology by all the teaching and learning faculty.
2. Students will experience opportunities to acquire technological knowledge and skills in the context of their regular course assignments.
3. Students will develop skills in the identification, selection, adaptation, organization, application, and evaluation of technological information and resources for learning/teaching.
4. Students will use technology to manage and complete administrative tasks.
5. Students will participate in e-mail and listserv activities that enhance communication within their own and with other Learning Communities.
6. Students will construct products representative of their knowledge and skills in both subject matter content and technology.
7. Students will demonstrate the ability to integrate technology with pedagogy.
8. Students will develop an electronic portfolio that is representative of their level of professional development.

In order to attain these goals, we then turned to the sequence of technological knowledge and skills. *When* certain skills should be introduced was an important consideration for the sequencing, but we also wanted to address *why* these skills were significant and *how* they could support the content of particular courses. This approach is consistent with Duffy & Bednar's (1991) suggestion that instructional designers seeking a constructivist approach to implementing technology should turn from structuring instruction to designing technological environments "which are characterized by rich contexts; authentic tasks; collaboration for the development and evaluation of multiple perspectives; an abundance of tools to enhance communication and access to real-world examples and problems" (p. 13).

Consequently, like the function of a room within a building often dictates the design of its environment, we tried to link content with technology that would enhance the learning environment of each class and would be embedded within the class content. Technology use would no longer be a course in isolation at the end of the curriculum, but be an integral part of meeting the objectives of each course. A stand-alone technology component in the Junior year, however, would allow students to gain advanced skills in multimedia production and to begin their electronic portfolios as well as make field trips to a distance learning classroom, Public Television studio, and area media resource centers. In our case, after the faculty had committed to full integration and set the goals, the department chair and a technology specialist began by identifying specific technological proficiencies that graduates of our teacher education program would be expected to have and distributed those proficiencies across the list of courses. The department faculty then met as a whole and negotiated additions, deletions, and modifications based on their own levels of expertise in technology and concerns for content integrity and innovation. Finally, the faculty voted unanimously in a formal department meeting that the implementation of the technology integration would begin with courses the following fall, agreeing that they would learn, demonstrate, and model the technology that we were asking the students to explore as outlined in Table 1.

Table 1. Elementary Certification Courses With Technology Integration Items

Course (Credits)	Technology Embedded or Modeled
Introduction to Education (1)	Technology in education classrooms: examples, teacher visits
Human Development (3)	Internet, WWW, E-mail, Online searches
Introduction. to Exceptional Children & Adults (3)	Adaptive devices for handicapped students, computer accessories
Learning & Assessment (3)	Online searches, electronic gradebooks, relational database, spreadsheet, HTML
Foundations of Education (3)	Overhead projector & transparencies, electronic presentation, copyright issues
Human Relations (3)	Importance of media in cultural, racial, gender, and age issues
Improving the Teaching of Science (3)	Utilities, course specific software, presentation use of CD-ROMs, LaserDisc, technology based learning centers, safety software, Web based lesson sources
Improving the Teaching of Mathematics (3)	Course specific related software, database
Improving the Teaching of Language Arts (3)	Utility software, course software, CD-ROM, word processing
Improving the Teaching of Social Studies (2)	Course specific software, atlas, CD-ROM encyclopedia
Improving the Teaching of Reading (3)	Course specific software
Literature of Childhood & Youth (2)	Course specific software, word processing, CD-ROM support for children's books
Physical Education & Health in Elem. School (3)	Course specific software, multimedia for health education.
Curriculum & Pedagogy (2)	Types of software and their uses, graphics programs, utility programs
Advanced Technology (2)	Multimedia, video recording, advanced presentation techniques, scanning, digitizing sound and video, HTML, CD-ROM re-purposing, electronic portfolio development
Student Teaching (11)	classroom practice in using technology, videotaping, portfolio refinement

The secondary curriculum follows the same outline for Foundations courses and Professional Practicum Semester, but substitutes one Methods for Secondary Teaching course in place of the Elementary Methods courses.

In an attempt to reduce the concerns that novices always have about whether the technology will really work, we modified classrooms within the School of Education so that physical environments were equipped for "switch-on" use: each classroom was equipped with a computer with a CD-ROM player, standard software, high intensity projector, LCD panel, online Internet connection, TV monitor, and VCR. In addition, a Macintosh classroom was outfitted for hands-on class instruction and development. Undergraduate students living in campus residence halls have been fortunate to have university-furnished computers in their rooms.

Construction

"And then one day it was. People rubbed their eyes, looked again, and saw a pearl-pale sculpture, grandiose yet fragile, floating above the water against a background of blue that set it off like a painting... the building of the century" (Godwin, 1995, p. 120–121). The Sydney Opera House has become a source of national pride, a symbolic landmark for Australia, but its creation was a nightmare, marked by long delays and chaos. The actual construction of this magnificent piece of architecture began in 1957 when Jorn Utzon, a Danish architect, won an international competition for its design. His vision of a building that would resemble sails on the water was filled with "untried techniques and daring innovations" (Godwin, p. 120) that were problematic for unskilled and careless workers who tried to continue construction from his plan when he abandoned the project because of bureaucratic and union troubles in 1966. Consequently, the building was not opened until 1973—16 years after its inception. These were problems we did not want to replicate as we sought to construct our own magnum opus, our techno-constructivist curriculum.

Learning from Utzon's experiences, we determined that before any construction could begin it was vital to obtain a work force that was capable and committed to the success of the project and to eliminate the "red-tape" commonly associated with higher education efforts. Because our faculty were the engineers and construction workers as well as the architects on this project, it was absolutely essential that they were comfortable with the technology integration process themselves.

Cummings (1995) has identified six categories of faculty resistance to the use of educational technology. Of those, two categories have to do with beliefs about teaching, but the other four categories are concerned with technological issues: knowledge, ease of use, resources, and the personal effort required. Fortunately, our faculty were committed to the notion of technology integration, so their apprehensions tended to fall into the category of how to build rather than whether to build. Therefore, we proposed several measures to make the work site more attractive and more conducive to success. Following the advice of Guskin (1996), we focused on "internal expertise... and supporting risk-takers" (p. 37). Our internal expert or general contractor has been a senior faculty member who understands the curriculum well enough to see and suggest possibilities, assist in identifying resources, *and* has the technological knowledge to guide implementation. One-course release time for this faculty member has made it possible to meet with other faculty individually to explore options, custom design materials consistent with course content, introduce the technology material to a class, or just attend a class to "troubleshoot" as needed. This approach has minimized the anxiety of the faculty about technology failure, reduced the feeling of isolation in teaching, and virtually eliminated an estimated "up to 6 years to master computer-based teaching practices and approaches" (Roblyer, 1997 p. 259) that has previously been reported. Even a "High-Tech/High-Touch" one-day retreat that provided some basic training in electronic presentation, Web page building, and electronic accessories was conducted internally by knowledgeable faculty/staff in order to extend our notion of a Learning Community into the electronic realm.

Construction requires building materials, and technological construction is certainly no exception. Budgetary constraints dictated that we identify generic software applications allowing multiple uses across courses and that are likely to be found in K–12 schools. Because we were building a custom structure, faculty continued to identify commercial and local subject-based software (some that was developed by our former graduate students who are classroom teachers) to enhance their course content. Accessories such as CD-ROM discs and players, digital cameras, scanners, film, video recorder/players, televisions, LaserDiscs, audio-tape recorders, liquid crystal display units, overhead projectors have augmented instruction and are available for use by both students and faculty.

Prototypes

The assignments briefly described in Table 2 are quite varied in terms of complexity, but are representative of assignments for phase one of this technology integration. These assignments were developed by the instructors for their respective courses. In most cases student introduction to the software was taught by the internal expert serving as a consultant for the class. For example, none of these faculty members had prior experience in working with a relational database, but the two who introduced it in their assignments were willing to learn, and they participated during the instructional sessions. The learning curve was reduced considerably by the development of template files. The structure of the template files was developed in consultation between the internal expert and the instructor of the course. The objective was to make learning to use the database and its application more important than learning the software. Focus for development was on the immediate use the students would make of the template, but also long-term needs so that the templates could be re purposed for a custom design.

Table 2. Prototypical Assignments Resulting From the Technology Integration Plan

Course	Complexity	Assignment
Secondary Methods	5	Find lesson resources on the WWW; Record essential information in a relational database file, use alternate layout to create mini-poster, contribute lesson resource to the course Web pages.
Science Methods	4	Track course progress on spreadsheet set up as electronic gradebook; Create lessons as Web pages; Present lesson to class using presentation software.
Learning & Assessment	3	Record professional development activities and products in relational database files as resources for electronic portfolio. Using a spreadsheet, develop an electronic gradebook consistent with assessment style.
Physical Education & Health	2	Use PowerPoint presentation and hypertext stacks developed by someone else as examples of how technology can enrich learning
Improving the Teaching of Reading to Childhood & Youth	1	Explore use of CD-ROM "Living Books"
Note: 5 = most complex		

The diversity present across the assignments serves to inform us of the necessity for continued development. The assignment continuum, not surprisingly, parallels a continuum on which the confidence and technology expertise of the faculty can be placed. For instance, on a continuum of background and expertise with the computer, from minimum expertise to expert in the use of technology for instruction, the instructors of the five courses listed in Table 2 would be placed in the same order as their assignments were on the scale of simple to complex. However, each faculty member found a way to meet the commitment for technology integration into their course, and each one has expressed a desire to build from this experience.

Discussion

Qualitative research through single case study design provides a unique focus with which to examine an event, an institution, a process, or a program. When close attention is applied to the context surrounding the case as well as the process within the case, an INUS explanation of the phenomenon within the case may be possible. First described by Mackie (1965), the INUS condition "explains effects resulting from a particular constellation of circumstances... individually *Insufficient* but *Necessary* factors in a set of conditions jointly *Unnecessary* but *Sufficient* to bring about the effect" (Krathwohl, 1993, p. 259). Table 3 depicts factors that contributed to the success of the integration project when the INUS condition is applied.

Table 3. INUS Explanation Applied to Case Study of the Integration Project

Insufficient but Necessary	Unnecessary but Sufficient
1. New design for technology integration	New curricular design at the same time
2. Administrative support for technology	Classrooms physically reconfigured
3. Small faculty (n=12) for development	Faculty supported by internal expert
4. Faculty attitude of acceptance	Acceptance early in the process
5. Students with access to resources	Students with ACT average of 25
6. Student enthusiasm = internal motivation for student continued use and learning	Student enthusiasm = external motivation for faculty continued use and learning

While this integration project has been remarkable for its smooth implementation, it has also created increased demands on resources: many faculty wish to be scheduled exclusively in technology-equipped classrooms, the Macintosh classroom is heavily booked and therefore difficult for students to access for development, machines need more speed and memory, and computer accessory equipment is now required by a variety of classes. In addition to these challenges, we face questions important to the continued interface of content and technology: Will the impetus for new construction be sustained? Can we demonstrate that our graduates are better prepared? Will our graduates use technology in their teaching when they leave the university? In any case, the dynamic nature of both learning and technology demand that we continue to design and implement functional, sound, attractive programs for the future.

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Internet Poster Session

Learning About Global Warming in a Virtual Environment

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Key Words: **global warming, virtual environments, virtual reality, climate**

Global Warming World (GWW) is an immersive virtual environment (VE) in which students can observe the causes and effects of air pollution over time. Students can control sources of pollution and can gather several kinds of information about the state of the atmosphere and ocean. The program runs on a Virtual Reality workstation that we take into schools as part of the Human Interface Technology Laboratory's educational outreach program.

In a typical visit to GWW, a student dons a VR helmet and holds a "wand" that allows movement through the environment and interaction with it. The student recognizes the VE as Seattle. Using a virtual tool kit, the student takes the temperature of the air and water, measures the amount of greenhouse gases in the atmosphere and measures the annual rainfall. The student then dials a year into the Temportal (GWW's time machine) and steps into the future. The student repeats the measurements. Other things the student might notice are changes in sea level due to shrinking or melting of the polar ice caps, changes in the number of trees, factories or vehicles and visible differences in the quality of the air. The student may then return to the present (or to any year) and turn cranks to change levels of pollution and the amount of green plant matter. Traveling in time to years already visited and repeating observations will show how these changes will affect global warming in the future.

We selected global change as our content for a variety of reasons. To begin with, it is important that students understand how sensitive the environment is to unchecked pollution. In addition, the topic is sufficiently complex to challenge most students and to allow us to give VR a rigorous test as a learning tool. Also, global change is interdisciplinary. Teachers and students can work with us to apply and develop knowledge in biology, chemistry, physics, social studies and math. Finally, many of the concepts and principles of global change are abstract and are therefore suited to a learning environment in which objects and ideas can be represented in concrete ways that allow direct physical actions to be performed on them—a feature of VEs that our research to date has found to hold the most promise for applying VR in education.

Our data gathered last year from students in two middle schools and one high school show that GWW helped them understand the basic principles and importance of global change. In addition, they enjoyed visiting the VE and were motivated by constructing their own objects to place in it. These findings add to data we are gathering from a number of projects that are shedding light on when and why VEs can and can not help students learn about complex topics.

We are working to make GWW a multi-participant distributed VE. This means that more than one person may visit at a time and that these people can be anywhere there is a high-speed connection to the Internet. Our current project places a student who is a patient at Seattle's Children's Hospital in GWW with a student from one of our collaborating schools. They work together to make measurements, travel in time and control global warming.

You may find out more about our work by visiting the following sites:

Human Interface Technology Lab. Learning Center home page with links to all past and present educational VR projects:
http://www.hitl.washington.edu/projects/learning_center/education.html

VRML fly-through of Global Warming World:
http://www.hitl.washington.edu/projects/learning_center/pf/

Internet Poster Session

ArtsEdNet: Bringing Art Into the Classroom With the Web

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Key Words: **ArtsEdNet, art, discipline-based art education**

This session introduces NECC '97 attendees to ArtsEdNet, the Web site of the Getty Education Institute for the Arts. A finalist for a 1997 Computerworld Smithsonian Award, ArtsEdNet offers a wide selection of lesson plans, curriculum ideas, and corresponding visual resources, making it a valuable site for art teachers as well as other teachers who would like to include art in their classes. ArtsEdNet, first launched in September 1995 by the Education Institute, features materials that illustrate a comprehensive approach to art education that involves, in addition to making art, art history, art criticism, and aesthetics. (This approach is known in the field as discipline-based art education, or DBAE.)

Because ArtsEdNet's classroom materials are based on this comprehensive approach, they are useful to teachers who have had little or no experience teaching art. Additionally, ArtsEdNet's teaching materials are organized in ways that address the needs of different teachers. Teachers will find lesson plans, cohesive units divided by grade level which provide detailed descriptions of activities and assignments for those seeking clearly defined ways to teach art.

ArtsEdNet also presents materials that provide necessary background information and suggest questions and activities that teachers can customize for their own students and situations. All the images on ArtsEdNet link to corresponding teaching materials available on the site. Artworks included come from many different countries and cultures, Western and non-Western, and from ancient to modern times. ArtsEdNet also provides links that teachers can use as jumping-off points for further exploration of the Web.

ArtsEdNet also features unique online exhibitions created expressly for the Web. Accompanying the online galleries are discussions with artists and educators in residence. These programs include suggested classroom activities that any teacher can use. Examples of past special guests and topics include Sandy Skoglund (installation art and photography), Jesus Moroles (large-scale sculpture), art and multicultural education, and inquiry-based thematic teaching.

ArtsEdNet visitors will also find selected readings and online exhibitions, a browsable catalog of Education Institute materials, news from the field of art education, and articles that can be used to gain support for quality arts education. Designed to be user-friendly and to download quickly, ArtsEdNet is a snap for new visitors to navigate. ArtsEdNet visitors may search the site using keywords. They can also join ArtsEdNet Talk, a listserv (currently with nearly 700 subscribers) that serves as an online discussion group and community of art educators. Sometimes called a "Virtual Teachers' Lounge," participants discuss issues of importance to them, as well as occasional special topics based around online exhibitions hosted ArtsEdNet.

As Excite Reviews noted, "Anybody who loves the arts and wants to see them well taught will find this an inspiring site from an inspired institution. Creative, innovative, and generous, they share it all here." Another online review, from ClNet's Best of the Web, calls ArtsEdNet "a successful melding of education, technology, and the arts.... (T)he future of art education is in good hands at ArtsEdNet." We hope that the NECC '97 audience will agree after they have had a chance to see ArtsEdNet for themselves.

Reviews of ArtsEdNet may be found at:

http://www.excite.com/Reviews/Arts/Fine_Arts/Museums_Around_the_World/American/index.html

http://www.cnet.com/Content/Reviews/Bestofweb/Reviews/0,60,344,00.html

(Please note: the Getty Education Institute for the Arts was formerly known as the Getty Center for Education in the Arts.)

Internet Poster Sessions

Oz Kidz on the Net—http://www.gil.com.au/ozkidz/

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Key Words: **Oz Kidz, teaching aids, Australia, teachers' resource center**

Teachers are under increasing pressure to be knowledgeable, even experts, in a growing number of areas including technology. They have identified lack of time, knowledge and the experience of frequent technical difficulties as being the main barriers to the implementation and use of technology as a tool in their classrooms. Many teachers report that they just do not have the time to sit down and learn about the technology and thus cannot think of the best ways that it could be incorporated into their programs. We have found that when teachers have used Oz Kidz to introduce themselves and the students in their class to the bewildering myriad of information that is the Internet, they are more prone to continue use of the resource because it helps them to learn. The Oz Kidz site has been designed by teachers for teachers and students to learn and to appropriate the technology in order to make the learning process not only more interesting, but more authentic.

The main areas that have been set up in the index are: About Oz Kidz, School home pages, literature, write, galleria, Ozpedia and careers. Below this the visitor can enter the Student or Teacher Cyber Centre or sign on for a Surf-e-mates (pen or key pals for communication). Thus, the purpose of the center is twofold: to assist visitors to find sites that are related to teaching and or education and to provide a medium by which Australian children can show their work to other interested children and adults in the world. At the moment schools that are connected can send their contributions electronically but news of the project has spread over the South East portion of Queensland and teachers and children who are not yet connected have made contributions that they would like to share with a wider audience. Then as they have gradually come online they can e-mail their contributions in.

Both the students and teachers cyber center sections are categorized so that the visitor can access portions of the net that interest them. For example, the teachers' cyber center offers teachers the opportunity to investigate; general education sites, sites related to specific curriculum areas such as English, language, mathematics, geography, history, science and the environment, and various other classifications such as other Australian sites, government and current affairs, school Internet projects, as well as help them to search other mailing lists for teachers and access newsgroups for teachers. If a teacher visits the sites in search of information about mathematics they would enter the Teachers Cyber Centre, and then via the math heading be able to investigate sites that are related to: math resources, math Internet links, Ask Dr. Math, Math magic, Biographies of women in mathematics, and various other mathematical topics of interest. Obviously, some of the areas have a greater range of options available, for example the choice in the area of General Education is extensive, and includes connections to Education K–12 resources, Magpie, The teachers place, as well as information on topics such as censorship and the Internet.

For students the categories of interest that can be explored include: general sites for kids, general education (great for school and home work research), Net picking (Internet tips), recreation, entertainment and sports, games, and a second avenue into surf-e-mates (key pals).

General Session: Technology Implementation/Educational Reform

Seeing Is Believing; Not! Media Literacy and Multimedia Production Into the Curriculum

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Key Words: **media, literacy, multimedia, production, technology, curriculum**

In this presentation we will look at how knowledge about race, ethnicity, cultural, and social diversity are constructed by media producers, disseminated through various media, and co-constructed by consumers. In this participatory presentation we will engage the audience in a variety of media literacy activities.

We will outline our experiences as media teachers, discuss our strategies for integrating media literacy into the curriculum, and look at some students' projects which have been made in media and multimedia formats. We will offer creative strategies for producing media in classrooms with limited resources and equipment. Media literacy education can provide students at any level and in any setting with critical, inquiry-based, student-centered, hands-on, collaborative learning experiences.

We will also examine the history of media literacy as a critical pedagogy, survey its range of international and national practices, and establish links with local groups involved with issues of community representation and media education. Particular emphasis will be placed on the development of media literacy strategies that work with and across different disciplines and communities.

In this presentation, we will also discuss how media literacy education provides opportunities for teaching other literacy skills—reading, writing, organizing ideas and concepts, and developing critical thinking skills—that can be applied in other subject areas. We will demonstrate how media literacy is a natural vehicle for teaching students to become activists for social justice and social change. Our linked focus on theory and practice provides students with a relevant sociopolitical context from which to critique, re-envision, and rebuild society.

In conclusion, the goal of this presentation, as our title suggests, is to draw on the natural links between media literacy education and technology. In this session, we will see how a critical approach to the study of media combines knowledge, reflection, and action, promotes educational equity, and prepares students to be socially responsible members of a multicultural, democratic society.

Media Literacy in a High School Classroom

As a media specialist at the Northfield Mount Hermon School, a private high school in Northfield, Massachusetts, I work with teachers from various disciplines to help them successfully integrate media technologies into their classes, as well as teaching them about media literacy education. As NMH prepares itself for the 21st century, the faculty and staff face the challenge of dealing with new forms of media and new technologies. Some of our experienced teachers, who have been very successful in their subject areas for many years, have been resistant to take up this challenge. Most of my students are much more courageous than their teachers in trying out new technologies, and they have come to media classes eager to produce movies or create Web pages.

In addition to consulting with teachers, I teach a media literacy and production course to 9th graders at NMH, a Humanities elective called Media Literacy/Library Research/Multimedia Production. I work with an international student body and at first I found it difficult to understand their expectations and experiences with the mass media. Because I came from Turkey and was myself unfamiliar with U.S. popular culture, especially television and films, I have learned to see myself as a student also. My training is in teaching and media production, but I did not know my student audience very well at first. During the three years I have worked at NMH, I have come to understand that we can learn a great deal from our students about various forms of popular media, as they spend much more time watching television and using communication technology than most of their teachers do.

In Turkey, I was taught to look at my teachers as the masters of their disciplines. I never questioned their wisdom, accepting what they taught me as truth. When I first worked in the United States as a student teacher, my cooperating teacher taught me that I do not have to know everything, that teachers are allowed to be life-long learners. I realize today that I cannot compete with my students' media experiences, so I use their expertise in this area to enrich my media literacy courses today. As a teacher, my familiarity with the products of U.S. popular media is less important than my ability to help my students develop inquiring minds and a critical understanding of U.S. culture, perspectives and beliefs. I consider myself to be more of a learning facilitator than the main source of knowledge for my students. With this in mind, I begin my media literacy course by giving my students a media survey to find out their interests and backgrounds.

As the course title suggests, it has three main components: critical viewing skills, library research skills, and an introduction to video production. My main goals are for students to be able to analyze different media, including moving image media, print media and Internet bulletin boards, and to produce their own videos and multimedia presentations based on library research. My students produce original projects using a multimedia authoring tool called HyperStudio, a camcorder, and an editing machine.

The Massachusetts Common Core of Learning (see resource list) has established that all students in the state should learn to use computers and other technologies to obtain, organize and communicate information; to seek, select, organize, and present information from a variety of sources; and to analyze, interpret, and evaluate information.

My course objectives, which complement the above goals, are for students to be able to locate, evaluate, record, and synthesize information from print, non-print, optical discs, and the Internet for their multimedia presentations; cite the resources they use; analyze and communicate through various media; demonstrate skill and creativity in authoring a multimedia production; revise and edit their own work and evaluate their peers' multimedia productions.

In order to learn to deconstruct and analyze media texts, students view a number of documentaries about the mass media (see resource list) as well as clips from news shows and advertisements which they log and analyze. One of the exercises I have used successfully involves analysis of the audio-visual "grammar" (Luke, 1994) of moving image media. As I tell my students, musicians use notes and scales in order to communicate, dancers use movement, and scientists use mathematical notations. Media producers also have a unique system of grammar and language, and learning to read it in all its complexity is crucial to being media literate. To this end, students, working in groups, are asked to analyze different aspects of media language, including sound, lyrics, color, lighting, camera angles, and movement, juxtaposition, and pacing of images, as well as character development, plot and setting.

My students also keep a media journal in which they record their own analysis of advertisements they see or hear during the course of the day. The journal is also used to record their responses to weekly readings and screenings in class. Most of my class discussions are shaped by students' media journals, which they are asked to share aloud.

Before they begin producing their own multimedia projects, my students spend two weeks researching their topics in the library. The school librarians teach them to evaluate the information they find for its authority, currency, and point of view. Students learn to take careful notes and to create a list of works cited which include the pictures and music they will use in their projects. In addition to books, students use the Internet, CD-ROMs, LaserDiscs, and other online research tools.

During the last few weeks of my media literacy course, students produce their multimedia projects. Working in groups, they learn to make numerous production decisions and to integrate their research into a multimedia of video format, adding their citations and credits at the end of the multimedia project. They present their projects to the class at the end of the term and receive feedback from their peers and teachers.

References

Luke, C. (May, 1994). Critical media literacy, cultural studies, cultural representations: Femininity and masculinity. *Interpretations, 27,* 1–15.

Luke, C. (1994). Feminist pedagogy and critical media literacy. *Journal of Communication Inquiry, Special Issue on "Critical Media Pedagogy" 18*(2), 27–44.

Resources

World Wide Web Sites

Aspen Institute:
http://www.kqed.org/fromKQED/cell/ml/home.html

Center for Media Literacy:
http://home.earthlink.net/~cml/index.html
http://home.earthlink.net~cml/

Directory of Media Literacy Organizations:
http://interact.uoregon.edu/MediaLit/FA/MLDirectory

Massachusetts Common Core of Learning:
http://www.doe.mass.edu:80/doedocs/commoncore/

Media Literacy Online Project:
http://interact.uoregon.edu/MediaLit/HomePage

Media Literacy Resource Catalog:
http://home.earthlink.net/~ cml/catalog.html

Media Watch:
http://interact.uoregon.edu/MediaLit/FA/MLMediawatch

Frontline Home Page:
http://mumford.pbs.org/programs/navigator/f-g.html

ERIC Virtual Library:
Gopher to: gopher://ericir.syr.edu

CNN Newsroom Guide:
http://www.nmis.org/NewsInteractive/CNN/Newsroom/A19960207/19960209/cnnGuide

Workshop

Creating Synthesis Projects in ClarisWorks

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Key Words: **ClarisWorks, university, newsletter, brochure, synthesis**

Abstract

In our introductory technology course in the College of Education, students use ClarisWorks to learn about word processing, graphics, and graphics design. As a final project, students design and produce a newsletter, a tri-fold brochure, a flier or a children's book, on a topic of their choice. These final projects go through approximately five drafts. Each draft of the project adds another component: overall layout, formatted text, subheads, and graphics. Each draft is critiqued both by classmates and course instructors. Most students feel that the process of creating these projects provides a very helpful synthesis of the skills that they have learned during the course. In addition to reviewing the skills learned during the term, students generally go beyond the minimum requirements as they gain increasing ownership of their projects.

In this session, we will examine the techniques needed to produce effective synthesis projects such as those completed in our university classes. We will focus on three major topics.

- techniques used in ClarisWorks to create a complex documents will be examined—although the concepts examined can apply to any software with graphics and text capabilities;
- basic design principles as they apply to beginners;
- examples of typical assignments given to students in the process of creating their projects as well as typical final products will be shared with participants.

This workshop will be of value both to those producing their own simple documents and those who want to use a complex document as a class activity. The workshop will be primarily lecture/demonstration with time for questions and discussion throughout. Participants will receive a packet of materials to help them get started on their own projects.

Author, Affiliation, and Key Word Index

3-D 341
3-D worlds 144
4th–7th grade 232

–A–

Abrams, Arnie 1
abstract science 308
access to technology 417
accessible Web design 149
accreditation 468
accreditation standards 268
acquiring technology 267
activities 488
Adair, A.L. 100
Adamczyk, Marj 383
Adamic-Makuc, Alenka 2
Adan, Bo 231
adaptive technology 196
Adkins, Bill 3
administration 102, 316
administrative issues 494
adult education 135, 204
adult learning 425
Advanced Placement (AP) Program 54
aeronautics 232
afterschool program 356
Altamonte Elementary 383
alternative assessment 15, 364
Altoona Schools 100
Ames, Kathy 280
Amill, Laura 185
Andelora, Sharon 4
Anderson, Diane 211
Anderson, Hugh 466
Anderson, Steve 501
Anderson-Inman, Lynne 5, 201
Anstendig, Linda 303
Apple Computer, Inc. 175
application software 34
appropriate use of the Internet in the classroom 193
Arakaki, Sharen 35
archaeology 229
Arizona State University 467
Arizona State University West 499
Armstrong, Pam 295
art 127, 512
arts 127, 482
arts integration 97
ArtsEdge 127
ArtsEdNet 512
assessment 1
assistive technology products 256
Aste, Margarita 6
astronomy 466
attitudes 417
augmentative communication 256
Aurora University 136
Aust, Ron 8, 9
Australia 513
authentic assessment 1
authoring 94, 348, 374
authoring languages 59
Aviano High School 211

–B–

background 485
Bagwell, Brenda 10, 199
Baker, Greg 11
Baker, Linda 60
Barnett, Eileen 14
Barrett, Helen 15
Barron, Ann 24
Barry University 417
basic skills 383
Battle Creek Elementary School 280
Baumbach, Donna 31
BBN Corp. 309, 322, 335
BBN, Inc. 358
Bedford North Lawrence High School 436
Begay, Joan 173
beginning 483
Belarussian-American exchange 229
Bellevue Community College 210
Bennett, Blythe 33
Bergeron, Cherie 34
Bess, Timothy 35
Best, Anita 401
Best, Tim 9
Bias, Gene 36
Bielefeldt, Talbot 37
Billings, Karen 39
Bingham, Margaret 41
Binnard, Willis 494
Birchall, David 42
Bird, Mary 31
Bitter, Gary 467
Bjelland, Kathy 470
Black, Sherman 362
Bland, Jana 49
blocking 281
Blumberg, Roger 9
BOCES 379
Bodey, Joan 280
Bogard, Jenna 309
Bogart, Jim 454
Bonine, Diane 172
Boone, Randall 53
Borthwick, Arlene 34
Boucher Owens, Barbara 54
Boulton, David 57
Bowen, Barbara 57, 501
Boyd, Beth 58
brain based research 318
bridging networks 92
brochure 518
Bromley, Barbara 232
Brown University 9
Brown Yoder, Maureen 59
Brown, Phyllis 356
browsers 341
building Web pages 358
bulletin boards 199
Burgstahler, Sheryl 59, 60
Burley-Glenwood Elementary School 92
Burniske, R. W. 278
Burrall, Bill 434
Burrall, William 278
Burton, Adam 396
business 91
business partnerships 222, 432
business plan 41
Buss, Alan 300
Butler, Judy 276
Butler, Rebecca 182
Butzin, Sally 67
Bytes of Learning Incorporated 503

–C–

C SALT 425
C++ language 54
C++ subset 54
Cable in the Classroom initiative 161
cable resources 161
cable TV 161
caching 151
Cal Poly, Pomona 232

calculators 310
California State University—Fullerton 24
California State University—Long Beach 9
California State University—Los Angeles 467
California State University—Monterey Bay 295
California State University—San Marcos 182, 211, 225, 467
Camp Verde Unified High School District 172
Campus Middle School 390
Canaday, Kathlynn 49
cancer 191
Canny, Dennis 470
Cappo, Marge 69, 295
captioning 274
career education 399
careers 280
Carey, Chris 36
Carey, Doris 70
Carriaro, Corrine 125
case 504
case study 354
Case, Bruce 259
Casey, Jean 78
Casson, Lucinda 483
CAST 203
Cates, Jeanette 84
Cavin, Cara 88
CD-ROM 94
censorship 281
Center for Applied Special Technology 203
Center for Children and Technology 305
Center for Research, Evaluation and Training in Education 175
Center for Special Needs Populations 278
centers 383
Central Indiana Educational Service Center 294
Central Lincoln People's Utility District 496
Centre for Studies in Advanced Learning Technology 425
CESA 11
Challenge Grants 97
Chambers, Sharon 214
Chandler Unified School District 384
change 99, 125, 142, 167, 173, 454
change theory 100
chaos theory 405
Chaparro, Neysa 88
Chaskin, Elizabeth 91
Chief Information Officer 307
Chiu, Chia Chee 8
Christal, Mark 360, 362
Christensen, Paul 92
chronic illness 191
citation 489
Citilcun 156 6
Civil War 317
Clabby, Michael 94
Claris Home Page 324
ClarisWorks 518
Clark, Erik 97
classroom 160, 226
classroom resources 78
climate 511
closed laboratory 354
Co-NECT 359
Coe, Mary Ann 96, 318, 319, 498
cognitive research 69
collaboration 3, 36, 69, 116, 125, 225, 232, 280, 311, 316, 461, 495
collaborative 359
collaborative learning 49, 348, 400
collegiality 319
commands 380
communal database 69
communication 120, 310, 471
communication disabilities 70
community 36, 190, 214
community access networking 174
community building 145
community computing 204
community involvement 163
community learning 501
community literacy 204
community partnership 356
community service 145
community study 364
community-based 324
community-based planning 353
community-based projects 335
community-based technology 353
computer camp 84
computer education 454
computer integration 67
computer labs 145
computer literacy 34
computer programming 136
computer publishing 197
computer science 54, 136, 432
computer software 310
computer teacher certification 268
computer-assisted instruction 478
computer-based instruction 175
computer-based learning 49
computer-mediated communication 60, 425
computer-supported collaborative learning 360
computers 9
computers and classroom culture 446
concept mapping 119
conceptually-based knowledge 260
connected learning community 145
connections 310
connectivity 279
constructionist learning 234
constructivism 118, 393
constructivist education 97
contemporary math topics 405
content labeling 281
cooperative groups 383
cooperative learning 88, 120, 364
corporate sponsor 432
Corpus Christi ISD 84
Corwin, John 266
cost effectiveness 41
Coufal, Kathy 97, 482
countries 491
Coursey, Henrietta 135
court schools 225
Coyne, Peggy 204
CPB/WGBH National Center for Accessible Media 274
Cradler, Ruthmary 211
CREATE 175
Criswell, Shelley 163
critical thinking 303
Crocker, George 112
Crompton, Marielizabeth 99
Cronheim, Deb 60
cross-curricular 190
cross-generational 385
CS 1 112
CS 2 112
CS1 354
CSILE 501
Cullum, Robbin 299
culture 8, 471, 491
Cumberland Science Museum 276
curriculum 33, 127, 185, 200, 287, 335, 379, 432, 504, 515
curriculum adaptations 196

curriculum integration 34, 39, 210, 234, 317, 403, 477
curriculum resources 130
customer service 287
CyberLibrary 258
CyberSchool 261
cyberspace 215
CyberTeacher 261
cybrarian 33

–D–

Dahl, Betty 100
data analysis 304
Davenport, Marla 100
Davies, Kevin 102
Davis, Bob 477
Davis, Hilarie 106
Dawson, Jerry 110
deaf 274
Dean, Susan 112
DeCosmo, Janice 113
Dede, Chris 114, 115
deFrey, Colette 97
Denton, Cynthia 116
Denton, Larry 116
Department of Defense Education Activity 181
description 96
design 181
develop 181
DiaCom Technology, Inc. 57
Dickeson, Linda 152
DiGiacomo, Adam 117
digital 379
Digital Chisel 1, 133, 333
digital learning 396
digital portfolios 1
digital publishing 53
Digital River 503
Dillon, Richard 118
director 94
disabilities 60, 196, 256
Disabilities, Opportunities, Internetworking, and Technology 60
disABILITY RESOURCES 255
disabled users 149
discipline-based art education 512
discovery-based learning 199
Dishman, Brad 34
Dishman, Edith 34
distance education 222, 403, 478
distance learning 3, 49, 116, 153, 160, 263, 350, 386, 399, 477, 502
District 833 35
dither 380
Ditson, Leslie 119
DO-IT 60
Dockterman, David 120
DoDDS 211
DoDEA 181
Donlan, Leni 121
Dosaj, Anita 221
Doty, Ben 496
Doty, Judith 496
Drake University 504
draw 380
Driver, Martha 302
DTD 235
Dunau, Andy 124
Dunne, James 125
Dyer, Michelle 501
dynamic migration 394

–E–

e-mail 2, 6, 215, 334, 385, 436, 498
Eakle, J. Kit 127
early childhood education 204
early childhood software 228
earth science 466
Eash, Dianne 130
East Tennessee State University 182
Eastern Kentucky University 492
economic development 497
Edgerton, Richard 113
Edmark 309, 489
education 9, 118, 127, 160, 200, 210, 468
Education Network of Ontario, The 365
education reform 57, 58, 97
education resources 200
Education Service Center—Region 20 468
education technology 39, 49
educational CD 459
educational multimedia development 228
educational partnerships 267
educational reform 96, 121, 222
educational research 114, 115
educational software 287, 309, 401, 489
Educational Support Systems 211
educational technology 110, 241, 454, 489
Educational Transformations, Inc. 57, 501
Edyburn, Dave 53
effective classroom environments 67
Eisenberg, Michael 132
Eisenhower Middle School 454
Electric Soup 331
electronic books 10, 201
electronic bulletin boards 437
electronic field trips 294, 295
electronic mail 437
electronic music 359
electronic portfolio 260, 277
electronic portfolios 1, 15, 371
electronic publishing 53
electronic studying 5, 119, 201, 232
elementary 165, 190, 210, 214, 277, 300, 304, 432, 499
elementary grades 175
elementary schools 24, 67
elements 380
Elwood, Susan 133
Encarta 488, 489
engaged learning 88, 226
engineering education 114, 115
environment 6, 393
environmental problem solving 276
Epp, Ed 354
equal access 201
equity in education 417
ERIC Clearinghouse on Information & Technology 132
Euclidian geometry 405
Eugene Public School District 4J 261
evaluation 236, 250
evaluation of Web sites 303

–F–

facilitate 181
faculty development 366
Falba, Christy 435
Falk, Kathleen 134
family literacy 204
Ferneding, Karen 360
fiber optics 497
firewall 258
Fisher, Steven 276
Flanders, Leslie 492
Fleming, Brent 91
Flentie, Susan 116
Fleury, Ann 136
flexible learning 425
Foltos, Les 142
Francis Pelton, Leslee 144, 341
Franco, Jay 145

Fraser, Beth 148
Frederick, Betsy 151, 152
freelance teaching 261
Friesen, Charles 152
Friske, Joyce 467
Fryatt, A. Margaret 153
Fulton Junior High School 163
fun 102
funding 114, 115, 497
funding sources 14
Furman University 487
future 379
future technologies 308

–G–

Gal-Ezer, Judith 432
Galtier Magnet Elementary School 234
Ganado High School 173
Garfield Elementary 116
Garner, LuAnn 276
gender 182
gender equity 276
gender issues 58
geography 190
geometry 144
George Mason University 403
George Washington University 281
Gershenson, Lou 160
Getty Education Institute for the Arts 512
Gibson, Beverly 276
Gilman, Mimi 161
girls 214, 280
GIS 300
Glendate Elementary School District 499
glide reflection 382
global classroom collaboration 278
global warming 511
Goals 2000 127
Gonzaga University 333
Goodman Elementary School 384
Gorland, Gary 162
Gotchy, Joseph 260
Gould, Karen 163
Grandgenett, Neal 482
grants 385, 482
graphics 373
graphing software 304
Green, David 165
Gregg, David 153
groupware 42, 57, 425
GUI 354
Gunn, Cathy 167, 172
Gusky, Norton Lewis 174
Guthrie, Larry 175
Gwaltney, Deborah 181

–H–

Hackettstown Public Schools 307
Haddad, Nick 335
Hakansson, Joyce 309
Half Hollow Hills School District 125
Hall, Linda 356
Hamline University 280
Hampton, Cathaleen 214
Handler, Marianne 402, 435
handouts 181
hands-on science 121
Hanfling, Seymour 9
Hanor, Joan 182, 225
hardware 102
Harris, Ellen 184
Harris, Judi 185, 187, 189
Hartsfield, Siri 469
Harvard Institute for International Development 335
Hayes, Rikki 385
health sciences 393
Healy Stearns, Peggy 190
Heise, Donalyn 97
Henley Management College 42
Herbert, Michael 191
heritage 197
Heritage Institute, The 386
Heritage OnLine 386
HERN 35
Higgins, Kyle 53
high school 316, 432
Highland Park Independent School District 3
Hill, Belinda 193
Hill, Juliane 393
Hillsborough Community College 357, 358
historical perspective 39
history 94, 317, 347
Hoberman, Cyndy 196
Hobson Public School 116
Hochsprung, Mary 197
Hodges, Linda 49
Hoffman, Bob 366
Holinga, Mike 469
Holmes, Beth 10
Holmes, Elizabeth 199
Holznagel, Don 9
Hopffgarten, Maggie 199
Horney, Mark 5, 201
hospitalized students 191
Hoyler, Maureen 201
HTML 133, 165, 235
Hughes, Bob 203
Hughes, Roy 210
Humanities 471
humor 121
Hunt, Adrianne 210
Hunter, Beverly 211
Hunterdon Central Regional High School 331
hypermedia 201, 364
hypermedia design 446
hypermedia environments 446
HyperStudio 133, 277, 287, 357
hypertext 371

–I–

Illinois State Board of Education 226
image processing 300
implementation 483
inclusion 70, 196, 306, 489
Indiana University 396
industry 210
information design 309
information literacy 249
information organization 5
information overload 221
information skills 142, 249
information technology 11, 487
informational dysfunction 221
InfoUse 232
infrastructure 92
innovation 130, 167, 173
innovation diffusion 189
inquiry 495
inservice 173, 470
inservice development 498
inservice programs 390
Institute for School Innovation, Inc. 67
Institute of Computer Technology 316
instruction 31
instructional CDs 10
instructional content 200
instructional design 34, 263
instructional development 241
instructional technology 331
integrate the K–12 curriculum 318
integrated curriculum 121

integrating technology in the curriculum 492
integration 173, 380, 482, 504
intellectual laziness 215
IntelliTools, Inc. 196
interactive 502
interactive instruction 299
interactive learning 113
Interactive Learning Design 309
interactive media 333
interactivity 393
interdisciplinary 181, 302
interdisciplinary project 260
intergenerational 197, 334
intergovernmental 497
international programs 229
International Society for Technology in Education 37, 308, 518
Internet 4, 8, 9, 31, 33, 34, 35, 53, 57, 59, 69, 100, 116, 132, 135, 144, 160, 181, 193, 226, 232, 236, 249, 250, 278, 279, 281, 299, 300, 319, 324, 325, 334, 364, 366, 371, 379, 385, 393, 400, 403, 417, 471, 487, 488, 491, 494, 502
Internet access 124, 258
Internet assistants 358
Internet chat 477
Internet facts 215
Internet research 437
Internet resources 287
Internet tools 396
Internet training 434
Internet-based instruction 263
Intranet 371
Isaacson, Robert 371
ISDN 399
ISTE 37, 38, 308, 401, 435, 518
ISTE-SIGTC 494
Ithaca City School District, Ithaca, NY 491
Ivers, Karen 24

–J–

Jacobs, Gloria 494
Jaeger, Mary Grace 212
Java 263
JDL Technologies, Inc. 258
Jeffers, Laura 305
Jefferson County Public Schools 212, 501
Jefferson Elementary School 469
Jenks Public Schools 467
Jessamine County Schools 491, 493
Johnson & Wales University 96, 318, 319
Johnson, Larry 236, 241, 250
Johnson, Vivian 280
Jones, Alex 477
Jones, Greg 185
Jordan, Elizabeth 214
Jukes, Ian 215, 221

–K–

Kajioka, Vicki 222
Kansas State University 454
Kavarsky, Mark 306
Kay, David 487
Kayenta High School 172
Keiper, Robert 223
Kelly, M. G. (Peggy) 211, 225, 467
Kelly, Penny 226
Kelly, Ronald 274
Kemp, Ilse 41
Kennedy Center 127
Kennedy, Adrienne 360
Kent State University 478
keyboarding 432, 493
keypals 385
Kid Pix 287
KIDLINK topic 2
kids rights 2
Killip Elementary School 172
Kinnaman, Mary Jo 163
Kirkley, Sonny 396
Klein, Marvin 228
Klimanovich, Olga 229
Klotz, Brenda 454
Kmoch, Joe 354
Knezek, Don 468
knowledge building 69, 501
knowledge tools 396
Knox-Quinn, Carolyn 119, 231
Knuth, Randy 9
Kraus, Lewis 232
Krocheski, Paul 234
Kung, Mou-Liang 234
K–12 34, 132, 311, 434, 468
K–12 curricula 187
K–12 curriculum 466
K–12 education 33, 446
K–6 students 197

–L–

Ladysmith Middle School 317
Lake Park High School 266
Lake Powell Academy 173
Lakeland Regional High School 498
Lakes Middle School 94
Lamb, Annette 235, 241, 249, 250
LAN 151, 279, 501
Langer, Kirk 152
language arts 67, 175, 196, 197, 317
Lankutis, Terry 255
Lanphier Computer Services 469
Lanphier High School 469
Lapping, Thomas 258
laptop computers 70
laptops 260, 372
Larson, Bruce 259
LaRue, Anne 172
Laserna, Catalina 335
Lauder, Richard 88
Lawrence Middle School 305
Layton, Tom 261
Lazar, Karen 305
leadership 99, 102, 121
learning 9, 42, 191, 299, 396, 491
learning disabled 274
learning in context 350
Learning in Motion 69
learning organizations 96
learning styles 100
learning technologies 114, 115
Lee, Jung 263
Lego 234
Lesley College 14, 59, 161
lesson plans 132, 200, 488
lessons 116, 488
Levin, Sandra 266
Levine-Fields, Louis 276
library computers 142
library media specialist 33
Lin, Janet Mei-Chuen 268
Lincoln County School District 496
Lincoln Public Schools 152
Litchfield High School 470
literacy 515
literature education 446
literature-based CDs 10
Live Cams 491
Loeterman, Mardi 274
Lofstrom, Marge 276
Logo 405
Logo programming 234
Long Island University 125
Los Angeles County Office of Education 350
Los Angeles Educational Partnership 124
Lotus Notes 316

Louisiana State University 467
Louisiana Tech University 467
low-income grants 124
low-income students 201
Lowe, Janis 277
Lynd, Chuck 278
Lysik, Gerald 498

–M–

MacDonald, Bryan 279
machine independent software 394
Macklem, Janet 97
Manhattan High School 454
Maplewood Elementary 163
maps 190
Marcus, Stephen 402
Marino, Susan 280
Martin, C. Dianne 281
Martin, George 498
Mason, LaRay 287
Masselos, Poppy 513
masters programs 454
math 88, 91, 116, 117, 383
math education 114, 115
mathematics 67, 232, 304, 310, 405
Mather High School 266
Mather, Mary Anne 287
Matheson, Jay 294
Matray, Kam 295
Mauldin, Mary 299
McArdle, Patricia 266
McCain, Ted 221
McClurg, Patricia 300
McCreary, Carol 287
McNeely, Andrea 259
Meadowbrook School 334
Meany Magnet School 145
media 515
Medical University of South Carolina 299
Melendez, Richard 400
mentoring 116, 280, 356, 434, 492
Merickel, Mark 311
Merideth, Eunice 504
Meskill, Carla 445
Meyer, Jeanine 301, 303
microcomputer-based labs 117
microscopic 287
Microsoft 38
Microsoft Authorized Academic Training Program 368
Microsoft Corporation 39, 267, 368
Microsoft Excel 117
Microsoft Official Curriculum 368
microwave 279
microworld 393
middle school 4, 335
mideo (video-microscopy system) 459
MIDI 359
Miles Grant, Cathy 304
misuse of technology 223
mock trials 121
Moe, Shirley 197
Moeller, Babette 305
Monterey Bay Aquarium, The 295
Monterey Peninsula Unified School District 295
Moon, Bobbie 210
Mooradian, Marsha 222
Moore, Robert (Lucky) 181
Morgan, Aletia 307
Morgan, Nancy 132
Moroh, Marsha 295
Morris Area Elementary School 485
motet 359
Moundsville Junior High School 278, 434
Moursund, David 38, 308
MP Express™ 503
MSD Wayne Township 163
MU* 477
MUD 477
multi-user 477
multicultural 417
multimedia 8, 10, 59, 91, 94, 121, 167, 173, 201, 210, 277, 309, 322, 324, 325, 333, 335, 348, 371, 374, 379, 461, 478, 487, 499, 502, 503, 515
multimedia curriculum 117
multimedia presentations 15
multimedia projects 466
multiple intelligences theory 318
museum 226
museum partnership 277
MUSH 477
music 359
Myers, Paul 487

–N–

Nagano Schlief, Marilyn 37
Nanny, Margo 309
NASA 502
NASA outreach 466
NASA Teaching From Space Program 502
National Council of Educational Opportunity Associations 201
National Foundation for the Improvement of Education 37
National Science Foundation 114, 115
National Taiwan Normal University 268
National Technical Institute for the Deaf 274
National-Louis University 402, 435, 477
Native Americans 8, 362
Nazworthy, Jim 9
NCEDA 201
NCTM 405
Nechako Electronic Busing Program 153
Nelson, Bryce 142
network 69, 92, 436, 471
networked communities 300
networking 322, 331, 371, 497
networking issues 152
new curriculum designs 318
Newberry, Brian 8
Newman School 347, 348
Newport High School 496
newsletter 518
NFIE 38
Nido, Virginia 372
Niess, Margaret 310, 311
NMSU 399
Nolan, Robert 316
Norfolk State University 234
Norris, Tom 259
North Carolina Department of Public Instruction 41
North Carolina Office of State Controller 41
Northern Arizona University 167, 172
Northfield Mount Hermon School 515
Northwestern University 477
notebook computers 11
notetaking 5, 232
Notre Dame Secondary School 373
Novakofski, Todd 317
number theory 405
Nupoll, Rick 350
NYC Board of Education 134

–O–

O'Bryan, Ellen 185
O'Neil, Patrick 92
O'Neill, Adrienne 96, 318, 319
Oakland Schools 494

object-oriented 112
oceanography 466
Oh, S. Phil 263
Ohio SchoolNet 9
Olds, Henry, Jr. 309, 322, 335
Olmstead, Jane 515
Oñate High School 399
one-computer classroom 459
ongoing professional development 425
online 181, 316, 417, 488
online activities 153
online curriculum activities 365
online facilitation 185
online forum 402
online professional development 386
Orange County Public Schools 36
Oregon State University 310, 311
organizational knowledge 57
organizational structures 311
organizational support 306
organizing 102
Osborne, Diogenes 477
Osborne, Martin 487
Ostler, Elliott 482
outlining 489
overview 485
Oz Kidz 513

–P–

Pace University 301, 303, 432
Padgett, Helen 499
Page Middle School 276
paint 380
Palos Verdes Schools 494
Pamenter, Kendra 324, 469
Pan, Alex 325
paperless communication 436
Pare, Ron 331
parent involvement 432
Parga, Michele 124
Parker, Angie 333
Parmley, Dianna 454
Parmley, John 454
participants 485
partnerships 38, 84, 91, 125, 163, 311, 497
partnerships with business 201
Patchett, Byron 503
patterns 382
Patterson Zaorski, Agnes 334
Pattison-Gordon, Laurie 335
pedagogy 487
peers 60
Pelton, Tim 144, 341
Pepperdine University 405
Peretti, Jonah 347, 348
Peri, Kristin 57
Perlman, Howard 348
Perry, Gayle 350
Peterson, Bill 351
PhotoShop 287
physical disabilities 232
Pierian Spring Software 110
plan 504
planning 9, 35
planning committee 353
planning models 435
PLUG 210
Poirot, James 49
policies 483
policy issues 494
Pollard, Debra 267
Pook, Charlanne 491
Pope, Jack 471
portability 394
Porter, Bernajean 353
portfolio storage 15
portfolios 197, 374
positive use of technology 223
poster session 152
practices 483
presentation 4, 133
presentation software 333
presentation technology 487
preservice 504
preservice development 498
preservice teachers 193
Prey, Jane Chu 354
Price, Bonnie 401
primary 190
principles 380
probeware 117
problem solving 234, 310, 383, 396
Prodigy 4
production 515
productivity 163, 316
productivity tools 53
professional development 11, 14, 38, 130, 167, 189, 211, 213, 225, 304, 306, 390, 402, 461, 499
program 485
program development 241
programming 341, 373
programming instruction 136
project 6, 84, 181
Project CHILD 67
project evaluation 482
project learning 364
project-based 322
project-based learning 121, 249, 357, 466
proxy 258
PSL Excelerator 117
public domain graphics 59
public education 99
Pundt, Joyce 355
Pusins, Dolores 357, 358

–Q–

quality teaching 401
Queensland University of Technology 513
question and answer service 33
question-answer services 132
QuickTime VR 324, 362
Quileute Tribal School 362
Quillayute Valley School District 351
Quipus S.A. 6

–R–

radiation 229
re-engineering 42
reading 67, 142, 165, 175
real-time data 466
reasoning 310
Recreational Software Advisory Council 281
reform 163, 210, 304
Reider, David 358
Reinhardt, May 14
related activities 485
remedial education 145
remote network access 331
remote-sensed data 466
repurposing 161
research 53, 277, 334, 372, 400, 489
researched composition 437
resource library 185
resource management 307
resource-based 142
resources 36, 488
responsibility 36
Resta, Paul 360, 362
Resta, Virginia 364
restructuring 470
reuse of code 136
Reynolds, Merry 317
Rhodes, Lewis 57

Rhodes, Sheila 365
Rice Creek Elementary School 355
Rice, Charles 432
Ritchie, Donn 366
Road Ahead Grant 356
Robbins, Gay 368
Roberts, Serena 371
robotics 118
Rocap, Kevin 9
ROCKMAN ET AL 372
Rockman, Saul 372
Rodrigo, Greg 373
role models 58
Roosevelt-Perry Elementary School 277
Rosenzweig, Laura 175
Ross, G. Robert 299
rotation 382
Roth, Emery (Ted) II 121
RSAC 281
Rubin, Andee 304
rural schools 211
Ryaby Backer, Patricia 374
Ryan, Karen 84

-S-

Sabu, Inc. 57
safe 258
Sale, Paul 70
Samford University 112
Samis, Mark 379
San Diego State University 366
San Jose State University 374
Sandak, Robert 125
Sandak, Ruth 125
SC State Museum 356
Scannell, Faye 380, 382
Scheer, Christine 383
Schneiderman, Bette 125
school community 348
school exchange 229
school reform 454, 461
school to work 399
School Transformation Plan 213
school-community 38
school-community networks 461
school-wide project 432
Schoolhouse 488
schools 497
schools-communities connection 124
Schumacher, Barbara 384
science 116, 117, 214, 434, 495
science curricula 113
science education 49, 114, 115, 295, 466
Scotch College 11
Scott County Schools 492
secondary 300, 373
secondary education 4
secondary schools 24
security 258, 334
selection 236, 250
self-confidence 58
Seminoff, Nancy 498
sensor probes 459
server 151
severe disabilities 70
Seymour, Mike 386
SGML 235
Sharp, Linda 390
Sharp, Margie 400
Sharpe, Jonathan 393
Shaughnessy Humanities School 432
Shriver, Barbara 181
Shub, Charles 394
Siegel, Martin 396
Sierra Middle School 400
SIG/Tel 152
Silicon Desert Consulting 151, 152
Silverman, Gene 398
Silverman, Stan 398
simulation 347
site-based 499
skill standards 210
Slade, Roger 11
Slovenia 2
Smith, David 152
Smith, Irene 518
Smith, Matty 42
Smith, Merle 279
Smith, Susan 399
Snyder, Tom 401
social isolation 60
sociology 347
software 102, 110
software design 309
software resource management 185
software support resources 287
Solomon, Gwen 401
Solomon, Stan 401
Solvie, Pam 485
Sony 160
Sony Electronics, Inc. 160
South Bay Advanced Education Technology Consortium 130
Southern Lehigh High School 229, 485
Southern Oregon State College 1
Southern Technology Council 483
Southwest Texas State University 364
space 466
Spanish 6
special education 196, 256
special needs 489
Sprague, Debra 403
spread-spectrum 279
spreadsheets 4
Springfield Public Schools 324
St. Austell Library 477
St. Edward's University 54
Staats, Gay 383
staff development 35, 59, 100, 125, 152, 163, 214, 287, 350, 390, 492
Stager, Gary 405
standards 454, 468
standards-based instruction 495
Stanger, Donna 309
Staron Baker, Sunny 417
State University of New York at Buffalo 190
Steeples, Christine 425
Stephenson, Chris 432
stereotypes 491
stock market 4
Stone, Randi 432
Storck, Steve 433
storytelling 197
strategic planning 307
strategies 119, 263
stress 99
Strudler, Neal 435
Stryker, John 436
student achievement 41, 163
student centered learning 121
student performance 175
student portfolio kit 1
student projects 36, 324
student research 489
student response 446
student teaching 153
student-constructed multimedia 302
student-directed learning 374
student-scientist partnership 495
subject matter experts 185
Sullins, John 437
summary 485

Sunburst Communications, Inc. 309
support 325
survey 325
Sutera, Linda 172
Swan, Karen 445
symmetry 382
synthesis 518
Syracuse University 33, 132
systemic change 163
systemic thinking 96

–T–

TAAS 91
Talab, Rosemary 454
Tan, Soo Boo 459
Tarratoris, Marilyn 211
Taylor, Harriet 467
Taylor, Melanie 477
teacher 9
teacher change 360
teacher collaboration 106
teacher development 175
teacher education 34, 241, 364, 498
teacher educators 189
teacher guides 466
teacher peer support 78
teacher preparation 268
teacher productivity 41
teacher training 78, 193, 204, 390, 403, 470
teacher's presence vs. technology 223
teacher/pathfinder 130
teachers as researchers 402
teachers' resource center 513
teaching aids 513
teaching dynamics 223
teaching standards 435
TEAM LABS 117
team teaching 88
teamwork 36
tech team 121
technical proficiency 368
technology 8, 9, 42, 67, 99, 100, 117, 118, 120, 135, 142, 182, 193, 200, 213, 214, 241, 249, 280, 304, 319, 468, 485, 504, 515
Technology and Information Technology Service 100
technology applications 498
technology considerations 121
technology coordination 311
technology coordinator 152
technology courses 241
Technology for Learning Consortium 106
technology history 110
Technology Hub 470
technology impact on society 221
technology implementation 58
technology infrastructure 311
technology innovation 97
technology integration 11, 41, 114, 115, 153, 175, 306, 435
technology integration in teaching and learning 311
technology leadership 454
technology learning tools 88
technology management 307
technology partners 267
technology plan implementation 307
technology planning 41
technology reform 41, 470
technology shortcomings 215
technology support 152
teen awareness 163
teen pregnancy 163
telecollaborative 334
telecommunication skills 153
telecommunications 2, 24, 78, 152, 167, 173, 211, 226, 278, 331, 334, 365, 495, 499
telecommunications projects 461
telecomputing 189
telecomputing projects 187
telecurricular communication 276
telelearning 295
telementoring 58, 185
Tenenbaum, Bonnie 461
Tenth Planet Explorations, Inc. 309
TERC, Inc. 494, 495
Terry, Kathee 466
tessellations 382
test 91
Texas 91
Texas State Aquarium 84
Texas Tech. University 133
text-based 477
The Dalton School 432
the fifth language 308
The North Shore Country Day School 165
The Open University of Isreal 432
The Well Connected Educator 401
Theatrix 309
Thomas Jefferson High School 259
Thomas, Lajeane 467
Thompson, Karen 469
Thornburg Center for Professional Development 102, 215, 221
Thurber, Barton 471
Thurber, Bonnie 477
Thurston, Catherine 266
Tiene, Drew 478
TIES 100
time 102
Tom Snyder Productions 120, 401
Tonsmann, Jose Aste 6
tools 396
Topp, Neal 482
Tornatzky, Louis 483
Town School 121
toxicology 393
training 366, 492
transformational geometry 382
translation 382
Trekell, William 477
Tremer, Walt 229, 485
Treu, Kevin 487
Trinity University 487
TRIO programs 201
Trowbridge, David 488, 489
Trower, Mary Ann 489
Tsekos, Nancy 211
Tucker, Kathy 173
Turing 373
Tuttle, Harry 491
TV 459
typing 493

–U–

U.S. Geological Survey 348
universal access design 149
university 518
University at Albany 445
University of Alaska Anchorage 15
University of California 402
University of California—Irvine 487
University of Central Florida 31
University of Colorado at Colorado Springs 70, 394
University of Illinois 266
University of Kansas 8, 371
University of Minnesota 280
University of Nebraska at Omaha 482
University of Nevada—Las Vegas 53, 435
University of North Texas 49
University of Northern Iowa 494

University of Oregon 5, 119, 201, 231, 518
University of San Diego 471
University of South Florida 24
University of Southern Indiana 235, 241, 249, 250
University of Texas at Austin 185, 187, 189, 278, 360, 362
University of Toronto 432
University of Victoria 144, 341
University of Virginia 354
University of Washington 59, 60, 113, 118, 191, 393, 511
University of Washington Libraries 148
University of Wisconsin—Milwaukee 53
University of Wisconsin—Whitewater 325
University of Wyoming 263, 300
UNIX 151
URL 299
use of technology for study of literature 302
using technology 96
UtahLINK—Utah Education Network 199
Utay, Carol 491, 493
Utay, Joe 492
Utter, Susan 84

–V–

Valley, Karen 425
Van Dam, Janet 494
Vande Putte, Matt 162
Vanguard for Learning 211
Vedoe, Cheryl 309
Vesel, Judy 494
Vetter, David 151
Vicenza High School 211
video 274
video production 294
videoconferencing 3, 294, 399, 502
videophone 229
videoscope 287
virtual 287
Virtual Canyon Project 295
virtual environments 511
virtual learning 222
virtual libraries 371
virtual museum 362
virtual museums 100
virtual reality 144, 191, 347, 511
visual literacy 491
visual programming 112
VRML 144, 341, 347
Vrotny, Vincent 165

–W–

Wake Forest University 58
Wallace, Julie 84
Walters, Christine 384
Walters, Joseph 495
WAN 279
Washington High School 354
water conservation 348
water science 348
water use 348
weather 466
Web integration 236, 250
Web page 133, 152
Web page design 187
Web page development 59
Web publishing 495
Web research 303
Web reviews 402
Web site 127
Web site listing 386
Web-based tools 396
Web-publishing applications 358
Web/HTML composition 302, 303
Webb, Kathy 200
WebTV 160
Wells, Elaine 496
Wepner, Shelley 498
West Virginia 434
West Virginia University 433
West, Gail 31
Western Montana College 116
Western Washington University 223, 228, 259, 487
Wetzel, Keith 499
Whittier College 401
Whitworth, Alan 501
Wiburg, Karin 399
Wiebe, James 467
Wild, Flint 502
Wilkinson, John 258
Willer, Art 503
William Paterson College 96, 318, 319
Williams, Hilda 504
Williamson County Schools 276
Wilson, Kim 501
Windows stacks 357
Wings for Learning 295
Winn, William 511
wireless 279
wiring 92
Within Technology, Inc. 57
Wolf, Carol 432
women 182
Wongse-Sanit, Naree 512
Woodcliff School 4
Woodd, Ed 162
work-based learning 425
workshop 325
world 6
World Band 359
World Wide Web 5, 8, 24, 31, 100, 113, 149, 151, 160, 165, 193, 232, 235, 319, 366, 379, 386, 417, 437, 471
World Wide Web technology 263
writing 165, 232, 274, 325, 385, 402
writing project 489

–Y–

Yelland, Nicola 513
Yildiz, Melda 515
Yoder, Sharon 518
Youngstown State University 437

–Z–

Zbikowski, John 325
Zeitz, Leigh 494

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